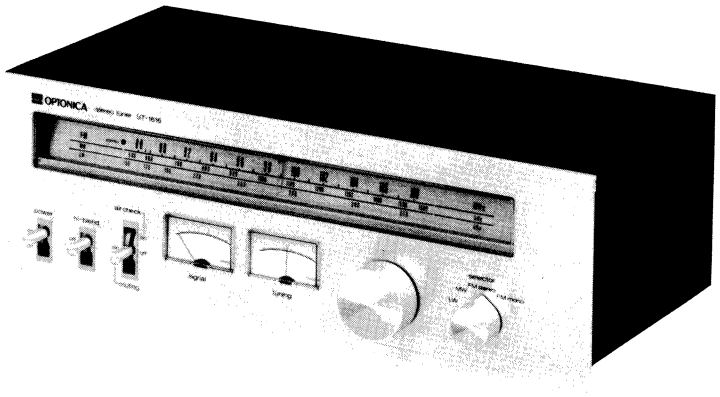
SHARP OPTONICA SERVICE MANUAL

ST-1616H
ST-1616HB



(PHOTO: ST-1616H)

FM/MW/LW

stereo tuner

MODEL

ST-1616H
(Silver Panel)

ST-1616HB
(Black Panel)

In the interests of user-safety the set should be restored to its original condition and only parts identical to those specified be used.

SPECIFICATIONS

GENERAL DESCRIPTION

Power source:	AC 110/220/240 V, 50/60 Hz
Power consumption:	10 W
Circuit:	Superheterodyne system, FM/MW/LW 3-band tuner, with PLL Stereo Demodulator (built in pilot cancell circuit), FM muting circuit, air check calibrator circuit, high blend circuit
Semiconductors:	3-IC (Integrated circuit) 1-FET (dual gate, MOS type) 10-Transistor 11-Diode (1-Zener Diode) 1-LED
Dimensions:	Width: 442 mm (17-7/16") Height: 144 mm (5-11/16") Depth: 267 mm (10-9/16")
Weight:	4.7 kg (10.4 lbs.)

FM

Tuning range:	87.6 ~ 108 MHz
IF:	10.7 MHz
Sensitivity:	1.6μV
(at S/N 30dB, 40kHz deviation)	
Image rejection:	80 dB (at 98 MHz)
I.F. rejection:	80 dB (at 98 MHz)
Selectivity:	54 dB
Capture ratio:	2.0 dB
AM suppression:	45 dB
Output voltage:	250 mV (40 kHz deviation)
S/N:	62 dB (40 kHz deviation)
Distortion:	mono: 0.5% stereo: 0.5%
Stereo separation:	40 dB (1 kHz)

AM(LW/MW)

Tuning range:	MW 520 ~ 1620 kHz LW 150 ~ 370 kHz
IF:	455 kHz
Quieting sensitivity:	MW 450μV/m LW 450μV/m
Image rejection:	MW 36 dB (at 1400 kHz) LW 35 dB (at 340 kHz)
I.F. rejection:	MW 40 dB (at 1000 kHz) LW 32 dB (at 340 kHz)
Distortion:	1.5%
Output voltage:	200 mV (400 Hz, 30% modulation)

Specifications are subject to change without prior notice.

SHARP CORPORATION OSAKA, JAPAN

DISASSEMBLY

Prior to removing the chassis, be sure to draw the power supply plug from a wall outlet. Then, proceed with the removal work in the following order after disconnecting all of the connection cords at the rear of the set.

1) To remove the cabinet:
Remove 8 screws ① retaining the cabinet (4 screws each for the right and left sides), then the cabinet can be detached.

2) To remove the bottom plate:
Turn over the set and remove 2 screws ② retaining the bottom plate, then the bottom plate can be taken out if withdrawed frontward.
Then, it becomes able to repair the P.W. Board. However, in order to further remove the front panel, take the following procedures.

3) To remove the front panel:
(1) Pull out the knobs ③ (5 knobs).
(2) Remove 4 screws ④ retaining the front panel, then the front panel can be detached.

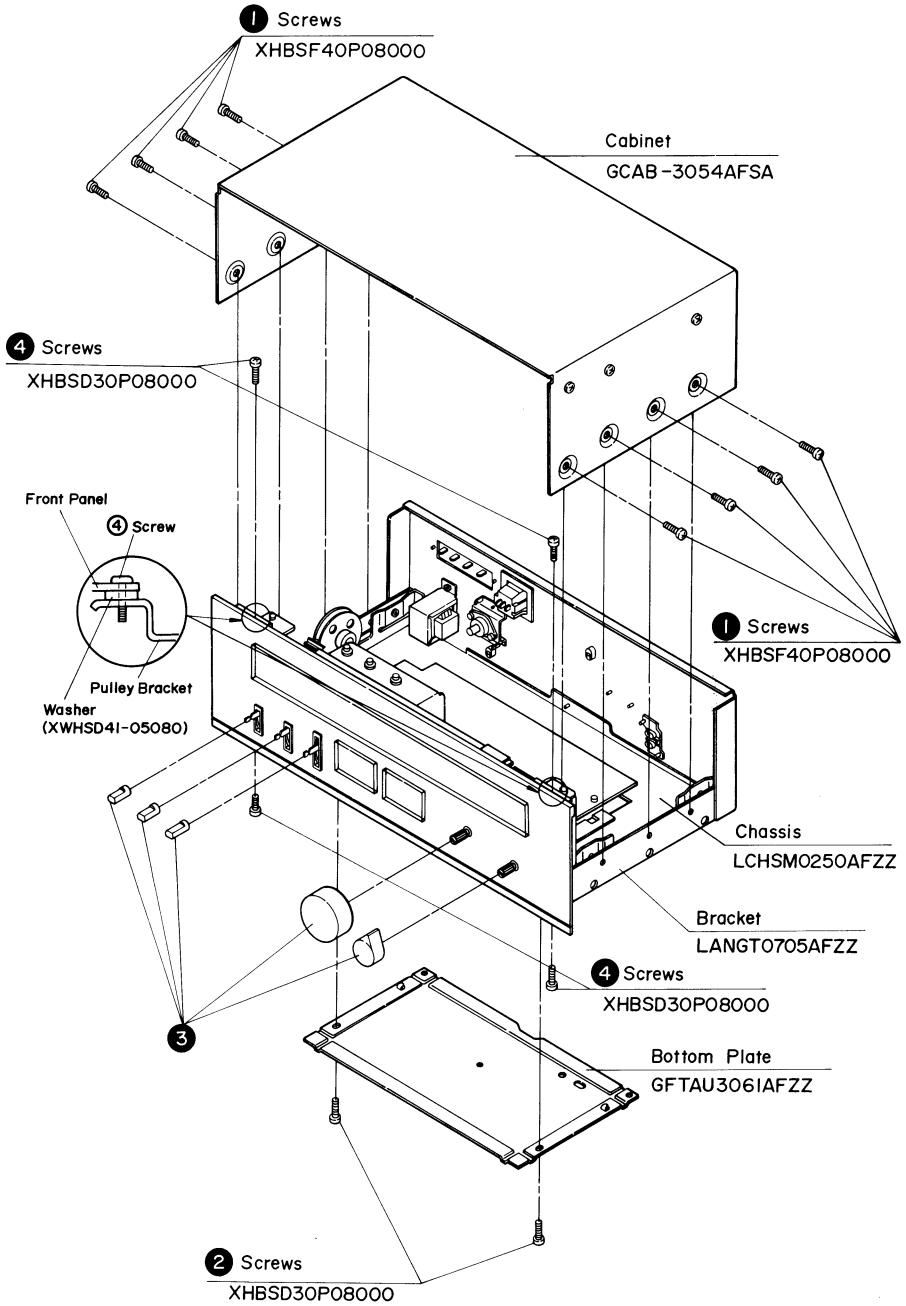


Figure 1 DISASSEMBLY

PARTS LIST

REF. NO.	PART NO.	DESCRIPTION	CODE
R103	VRD-ST2EE104J	100K ohm	AA
R104	VRD-ST2EE101J	100 ohm	AA
R105	VRD-ST2EE470J	47 ohm	AA
R106	VRD-ST2EE330J	33 ohm	AA
R107	VRD-ST2EE392J	3.9K ohm	AA
R108	VRD-ST2EE223J	22K ohm	AA
R109	VRD-ST2EE152J	1.5K ohm	AA
R110	VRD-ST2EE330J	33 ohm	AA
R111	VRD-ST2EE330J	33 ohm	AA
R112	VRD-ST2EE103J	10K ohm	AA
R113	VRD-ST2EE332J	3.3K ohm	AA
R114	VRD-ST2EE822J	8.2K ohm	AA
R115	VRD-ST2EE470J	47 ohm	AA
R116	VRD-ST2EE222J	2.2K ohm	AA
R117	VRD-ST2EE101J	100 ohm	AA
R118	VRD-ST2EE474J	470K ohm	AA
R119	VRD-ST2EE470J	47 ohm	AA
R120	VRD-ST2EE331J	330 ohm	AA
R121	VRD-ST2EE104J	100K ohm	AA
R122	VRD-ST2EE154J	150K ohm	AA
R123	VRD-ST2EE331J	330 ohm	AA
R124	VRD-ST2EE221J	220 ohm	AA
R125	VRD-ST2EE123J	12K ohm	AA
R126	VRD-ST2EE103J	10K ohm	AA
R127	VRD-ST2EE182J	1.8K ohm	AA
R128	VRD-ST2EE822J	8.2K ohm	AA
R129	VRD-ST2EE104J	100K ohm	AA
R130	VRD-ST2EE223J	22K ohm	AA
R131	VRD-ST2EE123J	12K ohm	AA
R132	VRD-ST2EE333J	33K ohm	AA
R201	VRD-ST2EE104J	100K ohm	AA
R202	VRD-ST2EE473J	47K ohm	AA
R203	VRD-ST2EE562J	5.6K ohm	AA
R204	VRD-ST2EE333J	33K ohm	AA
R205	VRD-ST2EE333J	33K ohm	AA
R206	VRD-ST2EE101J	100 ohm	AA
R207	VRD-ST2EE102J	1K ohm	AA
R208	VRD-ST2EE392J	3.9K ohm	AA
R209	VRD-ST2EE392J	3.9K ohm	AA
R210	VRD-ST2EE680J	68 ohm	AA
R213	VRD-ST2EE105J	1 Meg ohm	AA
R301	VRD-ST2EE152J	1.5K ohm	AA
R302	VRD-ST2EE152J	1.5K ohm	AA
R303	VRD-ST2EE101J	100 ohm	AA
R304	VRD-ST2EE680J	68 ohm	AA
R305	VRD-ST2EE333J	33K ohm	AA
R306	VRD-ST2EE273J	27K ohm	AA
R307	VRD-ST2EE103J	10K ohm	AA
R308	VRD-ST2EE103J	10K ohm	AA
R309	VRD-ST2EE471J	470 ohm	AA
R310	VRD-ST2EE100J	10 ohm	AA
R311	VRD-ST2EE823J	82K ohm	AA
R312	VRD-ST2EE223J	22K ohm	AA
R313	VRD-ST2EE331J	330 ohm	AA
R401	VRD-ST2EE561J	560 ohm	AA
R402	VRD-ST2EE562J	5.6K ohm	AA
R403	VRD-ST2EE331J	330 ohm	AA
R404	VRD-ST2EE331J	330 ohm	AA
R405	VRD-ST2EE472J	4.7K ohm	AA
R406	VRD-ST2EE332J	3.3K ohm	AA
R407	VRD-ST2EE223J	22K ohm	AA
R408	VRD-ST2EE153J	15K ohm	AA
R409	VRD-ST2EE152J	1.5K ohm	AA
R410	VRD-ST2EE104J	100K ohm	AA
R411	VRD-ST2EE223J	22K ohm	AA
R412	VRD-ST2EE103J	10K ohm	AA
R413	VRD-ST2EE103J	10K ohm	AA
R414	VRD-ST2EE823J	82K ohm	AA
R415	VRD-ST2EE223J	22K ohm	AA
R416	VRD-ST2EE103J	10K ohm	AA
R417	VRD-ST2EE184J	180K ohm	AA
R418	VRD-ST2EE181J	180 ohm	AA
R419	VRD-ST2EE392J	3.9K ohm	AA
R420	VRD-ST2EE222J	2.2K ohm	AA
R421	VRD-ST2EE104J	100K ohm	AA
R422	VRD-ST2EE104J	100K ohm	AA
R423	VRD-ST2EE121J	120 ohm	AA
R424	VRD-ST2EE104J	100K ohm	AA
R425	VRD-ST2EE473J	47K ohm	AA
R426	VRD-ST2EE473J	47K ohm	AA
R427	VRD-ST2EE821J	820 ohm	AA
R428	VRD-ST2EE332J	3.3K ohm	AA
R429	VRD-ST2EE332J	3.3K ohm	AA
R430	VRD-ST2EE391J	390 ohm	AA
R431	VRD-ST2EE391J	390 ohm	AA
R432	VRD-ST2EE122J	1.2K ohm	AA
R433	VRD-ST2EE392J	3.9K ohm	AA
R434	VRD-ST2EE392J	3.9K ohm	AA

MISCELLANEOUS

CPNLC3326AF01	Front Panel Assembly (ST-1616H)	–
GCOVA1075AFSC	Guide (Large), Lever Switch	AC
GCOVA1076AFSC	Guide (Small), Lever Switch	AC
PFLT-0316AF00	Felt, Front Panel	AB
HPNLC3326AFSA	Front Panel	–
CPNLC3326AF02	Front Panel Assembly (ST-1616HB)	–
GCOVA1075AFSB	Guide (Large), Lever Switch	AC
GCOVA1076AFSB	Guide (Small), Lever Switch	AC
PFLT-0316AF00	Felt, Front Panel	AB
HPNLC3326AFSB	Front Panel	–
CSPRT0304AF22	Dial Cord Assembly	–
GCAB-3054AFSA	Cabinet	–
GFTAU3061AFZZ	Bottom Plate	AB
GLEGP0059AFZZ	Leg	AB
HDALM0191AFSA	Dial Scale	–
HPNLC3326AFSA	Front Panel (ST-1616H)	–
GMADD0051AFSA	Window, Front Panel	AE
HPNLC3326AFSB	Front Panel (ST-1616HB)	–
GMADD0051AFSA	Window, Front Panel	AE
HSSND0243AFSA	Dial Pointer with Lamp (PL403)	AP
JKNBN0317AFSA	Knob, Tuning Control (ST-1616H)	AK
JKNBN0317AFSC	Knob, Tuning Control (ST-1616HB)	AK
JKNBN0330AFSA	Knob, Band Selector (ST-1616H)	AH
JKNBN0330AFSB	Knob, Band Selector (ST-1616HB)	AH
JKNBP0070AFSA	Knob, Power Switch, Air Check/Muting Switch and Hi-blend Switch (ST-1616H)	AH
JKNBP0070AFSC	Knob, Power Switch, Air Check/Muting Switch and Hi-blend Switch (ST-1616HB)	AG

PARTS LIST

REF. NO.	PART NO.	DESCRIPTION	CODE
	LANGQ0423AFZZ	Bracket, AM (LW/MW) Bar Antenna	AB
	LANGQ0510AFZZ	Bracket, Voltage Selector Socket	AB
	LANGQ0590AFSA	Rear Panel (ST-1616H)	–
	LANGQ0591AFSA	Rear Panel (ST-1616HB)	–
	LANGT0581AFZZ	Bracket, Pulley (Refer to Figure 2)	AB
	LANGT0582AFZZ	Bracket, Pulley (Refer to Figure 2)	AC
	LANGT0701AFZZ	Bracket, Pulley (Refer to Figure 2)	AB
	LANGT0705AFZZ	Bracket, Left/Right Hand Sides	–
	LBSHC0002AGZZ	Bushing, AM (LW/MW) Bar Antenna Lead Wire	AB
	LBSHC0004AGZZ	Bushing, Power Supply Cord (Refer to Figure 37)	AC
	LBSHC0007AFZZ	Bushing, Power Supply Cord (Refer to Figure 37)	AB
	LCHSM0250AFZZ	Chassis	–
	LHLDW1027AGZZ	Wire Holder (Refer to Figure 34)	AA
	LHLDW1053AFZZ	Wire Holder (Refer to Figure 34)	AB
	LHLDW1075AFZZ	Wire Holder (Refer to Figure 34)	AA
	MJNT-9050AFZZ	Connecting Cord, Band Switch	AH
	MSPRT0304AFFJ	Spring, Dial Cord	AA
	NDRM-0150AFZZ	Drum, Dial Cord	AF
	NPLYB0001SGZZ	Pulley, Dial Cord	AB
	NPLYC0101AFFD	Shaft, Pulley	AA
	NSFTD0168AFZZ	Tuning Shaft with Flywheel	AN
	NSFTS0052AFZZ	Selector, Band Switch, Rotary	AH
	PCOVU8110AFZZ	Cap, Meter Illumination Lamp, Green	AB
	PCUSG0069AF00	Cushion, Rubber, Chassis	AB
	PCUSS0076AFZZ	Cushion, Meter	AA
	PFLT-0340AFZZ	Felt, Cabinet	–
	PSHEF0110AFZZ	Felt, Power Switch, Air Check/Muting Switch and Hi-blend Switch	AA
	PSLDM3121AFZZ	Shield Plate, FM RF	AB
	PSLDM3125AFZZ	Shield Plate, FM Local Oscillation	AB
	PSPAI0119AFZZ	Spacer, 75 ohms FM Antenna Socket	AA
	PSPAZ0060AFZZ	Spacer, Light Emitting Diode (LED401)	AA
	QACCV0001AGZZ	Power Supply Cord with Plug (Refer to Figure 37)	AP
	QACCZ0053AF00	Power Supply Cord with Plug (Refer to Figure 37)	AK
	QACCZ0002TA0F	Power Supply Cord with Plug (Refer to Figure 37)	AF
	QACCL0001AFZZ	Power Supply Cord with Plug (Refer to Figure 37)	AR
	QANTW0051AFZZ	FM Indoor Antenna, T-shape	AH
	QCNW-0279AFZZ	Connection Cord, RCA Type	AK
	QFSHD1001AGZZ	Holder, Fuse	AB
F401	QFS-C800CAGNI	Fuse, 80mAT	AG
	QPWBF0738AFZZ	Printed Wiring Board	N.A.
SO401	QSOCZ2179AFZZ	Socket, DIN 45 325 Type FM Co-axial Antenna, 75 ohms	AF
SO402	QTANN0452AFZZ	Antenna Terminals, FM (75 ohms and 300 ohms) and AM	AF
SO403	QSOCE0410AGZZ	Socket, Voltage Selector	AH
SO404	QSOCJ2263AFZZ	Socket, Output	AD
SW401	QSW-B9073AFZZ	Switch, Power	AM
SW402	QSW-S0221AFZZ	Switch, Band (LW/MW/FM stereo/FM mono)	AL
SW403	QSW-B0064AFZZ	Switch, Air Check/Muting	AH
SW404	QSW-B0051AFZZ	Switch, Hi-blend	AK
SW405	QSW-F0123AFZZ	Switch, Muting, Leaf Type	AE
ME401	RMTRL0130AFSA	Meter, Signal (Strength)	AU
ME402	RMTRL0129AFSA	Meter, FM Tuning (Center)	AV
PL401, PL402	RLMPM0083AFZZ	Lamp, Meter Illumination (6.3V, 150mA)	AD
	SPAKA0514AFZZ	Packing Add., Cushion	–
	SPAKC1134AFZZ	Packing Case (ST-1616H)	–
	SPAKC1142AFZZ	Packing Case (ST-1616HB)	–
	SSAKH0015SEZZ	Polyethylene Bag, Set	AB
	TINSZ0114AFZZ	Operation Manual (English/German/French)	–
	TINSZ0139AFZZ	Operation Manual (Swedish)	–
	XBBSD40P45000	Screw, AM (LW/MW) Bar Antenna Retaining	–
	XHBSF40P08000	Screw, Cabinet	–
	XNESD40-32000	Nut, AM (LW/MW) Bar Antenna Retaining	
	XWHSD41-05080	Washer, Front Panel Retaining	–

A7806-3.5MNK
Printed in Japan

REPLACEMENT PARTS LIST

"HOW TO ORDER REPLACEMENT PARTS"

To have your order filled promptly and correctly, please furnish the following informations.

1. MODEL NUMBER
2. REF. NO.
3. PART NO.
4. DESCRIPTION

REF. NO.	PART NO.	DESCRIPTION	CODE
		INTEGRATED CIRCUITS	
IC101	RH-IX1005AFZZ	FM IF Amplifier and Detector (Quadrature) (HA1137W)	AT
IC201	RH-IX1105AFZZ	P.L.L. Stereo Multiplex Demodulator (HA11223)	AQ
IC301	RH-IX1072AFZZ	AM RF/IF Amplifier and Detector (HA1197)	AN
		TRANSISTORS	
Q101	VS3SK45-B//1F	Dual Gate MOS-FET, FM RF Amplifier (3SK45Ⓑ)	AM
Q102	VS2SC535-C/-1	FM Mixer (2SC535Ⓒ)	AD
Q103	VS2SC461-B/-1	FM Local Oscillator (2SC461Ⓑ)	AC
Q104	VS2SC460-B/-1	FM IF Amplifier (2SC460Ⓑ)	AC
Q301	VS2SC458-C/-1	Muting (2SC458Ⓒ)	AC
Q401	VS2SC1419-K1F	Ripple Filter (2SC1419Ⓑor Ⓒ)	AG
Q402	VS2SC458-C/-1	Air Check Oscillation (2SC458Ⓒ)	AC
Q403	VS2SC458LGC-1	AF Amplifier (2SC458LGⒸ)	AD
Q404	VS2SC458LGC-1	AF Amplifier (2SC458LGⒸ)	AD
Q405	VS2SC1740S/-1	Audio Muting (2SC1740Ⓢ)	AC
Q406	VS2SC1740S/-1	Audio Muting (2SC1740Ⓢ)	AC
		DIODES	
D101	VHD1S2076//-1	FM Local Oscillation Killer (1S2076)	AB
D102	VHD1N60////-1	Signal Meter, FM (1N60)	AB
D201	VHD1S2076//-1	V.C.O. Frequency Killer (1S2076)	AB
D202	VHD1S2076//-1	FM Muting (1S2076)	AB
D401	VHD10E1////-1	Power Rectifier (10E1)	AC
D402	VHD10E1////-1	Power Rectifier (10E1)	AC
D403	VHD1S2076//-1	Power Rectifier, Audio Muting (1S2076)	AB
D404	VHD1S2076//-1	Power Rectifier, Audio Muting (1S2076)	AB
D405	VHD1S2076//-1	Audio Muting (1S2076)	AB
D406	VHD1S2076//-1	Rectifier, Audio Muting (1S2076)	AB
ZD401	VHEHZ12-BBK-1	Zener Diode, Voltage Regulator (13.1V ± 0.4V) (HZ-12Ⓑ)	AD
LED401	VHPGL32AR//-1	Light Emitting Diode, FM Stereo Indicator (GL-32AR)	AD

REF. NO.	PART NO.	DESCRIPTION	CODE
		COILS	
L101	RCILA0407AFZZ	FM Antenna	AE
L102	RCILR0312AFZZ	FM RF	AE
L103	RCILR0313AFZZ	FM RF	AE
L104	RCILC0003AGZZ	FM Trap	AB
L105	RCILB0386AFZZ	FM Local Oscillation	AE
L106	RCILZ0052AFZZ	18μH, Phase Shifter	AB
L107	VP-LH220M0000	22μH, +B Choke	AB
L301-A, B	RCILA0426AFZZ	AM (LW/MW) Bar Antenna	AT
L302	RCILB0429AFZZ	LW Local Oscillation	AD
L303	RCILB0395AFZZ	MW Local Oscillation	AD
L304	VP-LH222K0000	2.2mH, IF Trap	AB
L305	VP-LH2R2M0000	2.2μH, Choke	AB
		TRANSFORMERS	
T101	RCILI0237AFZZ	FM IF	AE
T102	RCILD0058AFZZ	Quadrature (10.7MHz)	AD
T103	RCILD0059AFZZ	Quadrature (10.7MHz)	AD
T301	RCILI0200AFZZ	AM IF with Ceramic Filter	AG
T302	RCILI0216AFZZ	AM IF	AD
T401	RTRNP0552AFZZ	Power	AS
		FILTERS	
CF101	RFILF0062AFZZ	FM IF, Ceramic [2 ceramic filters to be used in a set as a pair should be of the same type (the same color)].	AF
CF102	RFILF0062AFZZ	FM IF, Ceramic	AF
FL201	RFILL0052AFZZ	Low-Pass Filter (19kHz and 38kHz)	AH
FL202	RFILL0052AFZZ	Low-Pass Filter (19kHz and 38kHz)	AH
		CONTROLS	
VC101, VC102, VC103, VC104, VC301, VC302, TC101, TC102, TC103	RVC-C0057AFZZ	Variable Capacitors, Tuning with Trimmers TC101; FM Antenna Trimmer TC102; FM RF Trimmer TC103; FM RF Trimmer	AX
TC104	RTO-H1001SGZZ	Trimmer Capacitor, FM Local Oscillation	AD
TC301, TC302	RTO-H2033AGZZ	Trimmer Capacitor TC301; MW Antenna TC302; LW Antenna	AE

PARTS LIST

REF. NO.	PART NO.	DESCRIPTION	CODE
TC303, TC304	RTO-H2033AGZZ	Trimmer Capacitor TC303; LW Local Oscillation TC304; MW Local Oscillation	AE
VR201	RVR-M0125AFZZ	3K (B) ohm, V.C.O. Frequency Adjust	AC
VR202	RVR-M0131AFZZ	100K (B) ohm, Pilot Signal Cancel Adjust	AC
VR401	RVR-M0131AFZZ	100K (B) ohm, Air Check Level Adjust	AC
VR402	RVR-M0127AFZZ	10K (B) ohm, Stereo Separation Adjust	AC
		ELECTROLYTIC CAPACITORS	
C127	VCEAAU1CW106Y	10MFD, 16V, +50 –10%	AB
C128	VCEAAU1EW475A	4.7MFD, 25V, +75 –10%	AB
C130	VCEALU1HW474M	.47MFD, 50V, ±20%, Yellow	AB
C135	VCEALU1HW334M	.33MFD, 50V, ±20%, Yellow	AB
C201	VCEAAU1HW335A	3.3MFD, 50V, +75 –10%	AB
C204	VCEALU1HW335M	3.3MFD, 50V, ±20%, Yellow	AC
C205	VCEALU1HW474M	.47MFD, 50V, ±20%, Yellow	AB
C206	VCEALU1HW335M	3.3MFD, 50V, ±20%, Yellow	AC
C210	VCEALU1HW334M	.33MFD, 50V, ±20%, Yellow	AB
C211	VCEALU1HW334M	.33MFD, 50V, ±20%, Yellow	AB
C212	VCEAAU1CW227Y	220MFD, 16V, +50 –10%	AC
C215	VCEALU1HW334M	.33MFD, 50V, ±20%, Yellow	AB
C216	VCEALU1HW334M	.33MFD, 50V, ±20%, Yellow	AB
C313	VCEAAU1CW106Y	10MFD, 16V, +50 –10%	AB
C314	VCEAAU1CW106Y	10MFD, 16V, +50 –10%	AB
C318	VCEALU1HW104M	.1MFD, 50V, ±20%, Yellow	AB
C320	VCEAAU1HW335A	3.3MFD, 50V, +75 –10%	AB
C321	VCEAAU1EW475A	4.7MFD, 25V, +75 –10%	AB
C322	VCEAAU1HW105A	1MFD, 50V, +75 –10%	AB
C404	VCEAAU1EW108Y	1000MFD, 25V, +50 –10%	AF
C405	VCEAAU1EW227Y	220MFD, 25V, +50 –10%	AC
C406	VCEAAU1CW227Y	220MFD, 16V, +50 –10%	AC
C408	VCEAAU1HW335A	3.3MFD, 50V, +75 –10%	AB
C409	VCEAAU1AW107Y	100MFD, 10V, +50 –10%	AB
C415	VCEAAU1CW106Y	10MFD, 16V, +50 –10%	AB
C416	VCEAAU1CW336Y	33MFD, 16V, +50 –10%	AC
C418	VCEAAU1CW336Y	33MFD, 16V, +50 –10%	AC
C419	VCEAAU1CW107Y	100MFD, 16V, +50 –10%	AC
C420	VCEAAU1HW105A	1MFD, 50V, +75 –10%	AB
C421	VCEAAU1HW105A	1MFD, 50V, +75 –10%	AB
C422	VCEAAU1EW106Y	10MFD, 25V, +50 –10%	AB
		CAPACITORS	
(Unless otherwise specified capacitors are 50V, +80 –20%, Ceramic Type).			
C101	VCCTPU1HH150J	15PF, 50V, ±5%, Ceramic TH (Blue)	AB
C102	VCCSPU1HL271K	270PF, 50V, ±10%, Ceramic	AB
C103	VCKZPU1HF223Z	.022MFD	AA
C104	VCKZPU1HF222Z	.0022MFD	AA
C105	VCKZPU1HF222Z	.0022MFD	AA
C106	VCKZPU1HF223Z	.022MFD	AA
C107	VCCTPU1HH180J	18PF, 50V, ±5%, Ceramic, TH (Blue)	AB
C108	VCKZPU1HF223Z	.022MFD	AA
C110	VCCTPU1HH180J	18PF, 50V, ±5%, Ceramic, TH (Blue)	AB
C111	VCCRPU1HH150J	15PF, 50V, ±5%, Ceramic RH (Yellow)	AB
C113	VCCCPU1HH1R0C	1PF, 50V, ±0.25PF, Ceramic, CH (Black)	AA
C114	VCCSPU1HL221K	220PF, 50V, ±10%, Ceramic	AB
C115	VCKZPU1HF223Z	.022MFD	AA
C116	VCKZPU1HF223Z	.022MFD	AA
C117	VCKZPU1HF223Z	.022MFD	AA
C118	VCCRPU1HH220J	22PF, 50V, ±5%, Ceramic, RH (Yellow)	**
C119	VCCRPU1HH7R0D	7PF, 50V, ±0.5PF, Ceramic, RH (Yellow)	**
C120	VCCTPU1HH180J	18PF, 50V, ±5%, Ceramic, TH (Blue)	AB
C121	VCCSPU1HH7R0D	7PF, 50V, ±0.5PF, Ceramic, SH (Green)	**
C122	VCKZPU1HF103Z	.01MFD	AA
C124	VCKZPU1HF223Z	.022MFD	AA
C125	VCKZPU1HF403Z	.04MFD	AB
C126	VCKZPU1HF403Z	.04MFD	AB
C129	VCCSPU1HL271K	270PF, 50V, ±10%, Ceramic	AB
C131	VCKZPU1HF403Z	.04MFD	AB
C132	VCKZPU1HF403Z	.04MFD	AB
C134	VCKZPU1HF403Z	.04MFD	AB
C136	VCKZPU1HF403Z	.04MFD	AB
C137	VCCSPU1HL391K	390PF, 50V, ±10%, Ceramic	AB
C140	VCKZPU1HF223Z	.022MFD	AA
C202	VCQSMT1HS102J	1000PF, 50V, ±5%, Styrol	AB
C203	VCQYKU1HM222K	.0022MFD, 50V, ±10%, Mylar	AB
C207	VCQYKU1HM473K	.047MFD, 50V, ±10%, Mylar	AC
C208	VCQYKU1HM152K	.0015MFD, 50V, ±10%, Mylar	AB
C209	VCQYKU1HM103K	.01MFD, 50V, ±10%, Mylar	AB
C213	VCQYKU1HM153J	.015MFD, 50V, ±5%, Mylar	AC
C214	VCQYKU1HM153J	.015MFD, 50V, ±5%, Mylar	AC
C219	VCQYKU1HM123K	.012MFD, 50V, ±10%, Mylar	AB
C303	VCQSMT1HS181J	180PF, 50V, ±5%, Styrol	AB
C304	VCCUPU1HJ680J	68PF, 50V, ±5%, Ceramic, UJ (Violet)	**
C305	VCQSMT1HD331G	330PF, 50V, ±2%, Styrol	AD
C306	VCCXPU1HL100F	10PF, 50V, ±1PF, Ceramic, XL	AB
C307	VCKZPU1HF403Z	.04MFD	AB
C308	VCKZPU1HF403Z	.04MFD	AB
C309	VCKZPU1HF102Z	.001MFD	AA
C310	VCCSAT1HL560J	56PF, 50V, ±5%, Ceramic	**
C311	VCKZPU1HF103Z	.01MFD	AA
C312	VCTYAT1EX103N	.01MFD, 25V, ±30%, Ceramic	**
C316	VCKZPU1HF102Z	.001MFD	AA
C317	VCQYKU1HM683K	.068MFD, 50V, ±10%, Mylar	AC
C319	VCKYAT1HD102M	.001MFD, 50V, ±20%, Ceramic	**
C323	VCCSPU1HL100K	10PF, 50V, ±10%, Ceramic	AA
C401	RC-PZ062CAFZZ	.033MFD, AC 450V, Oil	AG
C402	VCKZPU1HF103Z	.01MFD	AA
C403	VCKZPU1HF103Z	.01MFD	AA
C407	VCKZPU1HF223Z	.022MFD	AA
C411	VCQYKU1HM223M	.022MFD, 50V, ±20%, Mylar	AB
C412	VCQYKU1HM223M	.022MFD, 50V, ±20%, Mylar	AB
C413	VCQYKU1HM223M	.022MFD, 50V, ±20%, Mylar	AB
C414	VCQYKU1HM223M	.022MFD, 50V, ±20%, Mylar	AB
C423	VCKZPU1HF103Z	.01MFD	AA
C424	VCKZPU1HF403Z	.04MFD	AB
		RESISTORS	
(All resistors are 1/4W, ±5%, Carbon Type).			
R101	VRD-ST2EE105J	1 Meg ohm	AA
R102	VRD-ST2EE104J	100K ohm	AA

** : Price will be quoted upon receipt of order.

NOTES ON SCHEMATIC DIAGRAM

1. Frequency range: FM; 87.6 to 108 MHz
   MW; 520 to 1620 kHz
   LW; 150 to 370 kHz
2. IF: FM 10.7 MHz,
   AM (MW/LW) 455 kHz
3. Resistor: To differentiate the units of resistors, such symbols as K and M are used; the symbol K means 1000 Ω and the symbol M means 1000K Ω and the resistor without any symbol is Ω-type resistor.
4. Capacitor: To indicate the unit of capacitor, a symbol P is used; this symbol P means micro-micro-farad and the unit of the capacitor without such symbol is microfarad.
   As to electrolytic capacitor, the expression "capacitance/with-stand voltage" is used.
   Further the symbols ML and S as to the capacitor show respectively mylar type and styrol type capacitor: the capacitor without any of those two symbols refers to a ceramic capacitor.
5. SW401: It is Power (on/off) switch ("off" position).
6. SW402: It is Band selector (LW/MW/FM stereo/FM mono) switch ("FM stereo" position).
7. SW403: It is Air check/Muting switch ("air check off/muting on" position).
8. SW404: It is Hi-blend (off/on) switch ("off" position).
9. SW405: It is Muting switch.
10. ---------- The indicated voltage in each section is the one measured by VTVM between such a section and the chassis with no signal being given. (Set the band selector switch at "FM stereo" position and air check/muting switch at "air check off/muting on" position)

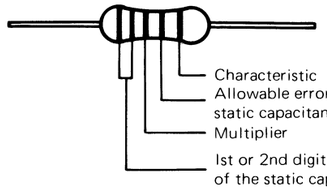
REFERENCE

■ **Cylindrical ceramic capacitor**

As you know, we Sharp have already employed computerized automatic inserting machines in our production line by which most of the parts like the resistor, diode and jumper wire except for the ceramic capacitor can be automatically attached onto the printing wired boards (PWB's) of complete sets like stereo system, radio set, TV set, etc. However, a recently technical development of ours now enable us to automatically set the ceramic capacitor to the PWB also, by using the automatic inserting machine. In this connection, it must be noted that this cylindrical ceramic capacitor is different from the conventional one (the disk-formed one) but it is the same in the aspects of shape and size as the carbon film resistor (of either 1/8 W or 1/4 W). Therefore, it is very liable to occur that the cylindrical ceramic capacitor and carbon film resistor are taken for each other at the time of servicing: the following reveals what specifications the cylindrical ceramic capacitor has.

■ **Identification of Capacitors**

As for the capacitors used in this set, they can be identified by the color indication on them concerning the nominal static capacitance, allowable error and characteristic.


Characteristic
Allowable error of the static capacitance
Multiplier
Ist or 2nd digit value of the static capacitance

Color difference	1st or 2nd digit value of the static capacitance	Multiplier	Allowable error of the static capacitance	Characteristic (*)
Black	0	10^0	±20% (M)	CH
Brown	1	10^1		LH
Red	2	10^2		D
Orange	3	10^3	±0.25pF (C)	PH
Yellow	4	10^4		RH
Green	5	–	±0.5pF (D)	SH
Blue	6	–		TH
Violet	7	–		UJ
Gray	8	–	±30% (N)	X
White	9	–		SL
Gold	–	10^{-1}	±5% (J)	
Silver	–	10^{-2}	±10% (K)	B

(*) JIS listed

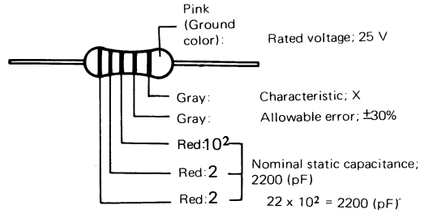
■ **Unit**

The values of static capacitance shown in the above table are of the unit pF (picofarad = micro-microfarad).

■ **The rated voltage of a capacitor can be seen from its ground color.**

Pink: . . . . . 25 V
Yellowish-green: . . . . . 50 V

■ **Example for the identification**



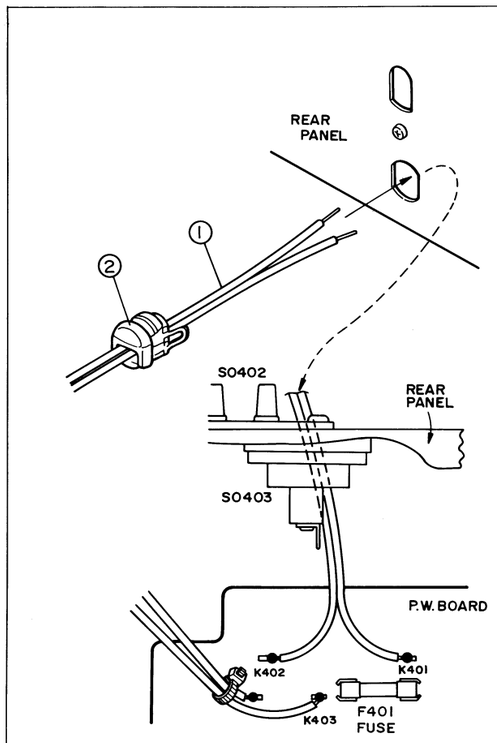


Figure 37–1

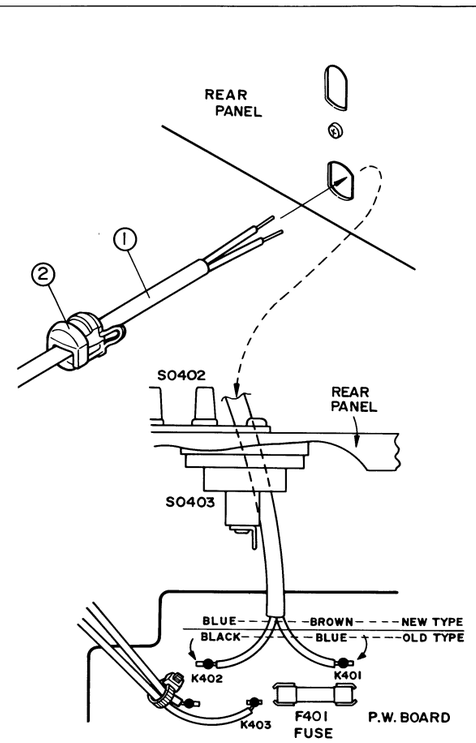
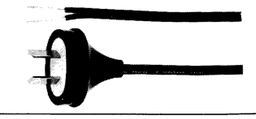
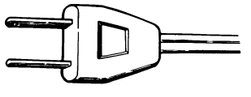
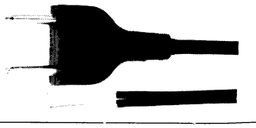
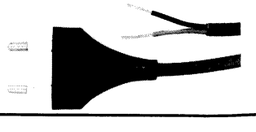
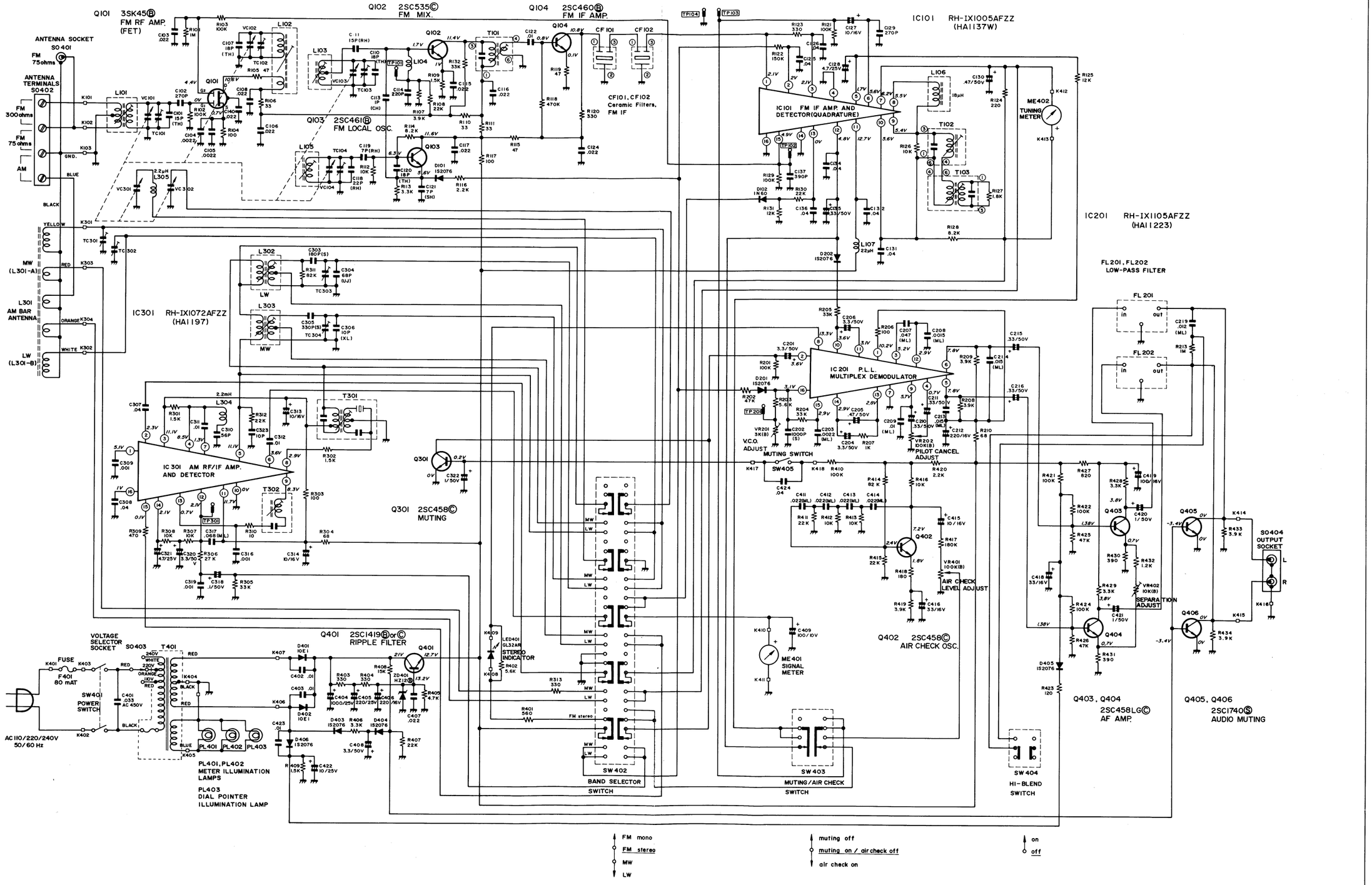


Figure 37–2

Figure 37 POWER SUPPLY CORD WIRING CONNECTIONS

POWER SUPPLY CORD ①	BUSHING ②	CONNECTION			
		FIGURE	K401	K402	
QACCL0001AFZZ	LBSHC0007AFZZ	Figure 37-1	/	/	
QACCZ0002TA0F	LBSHC0007AFZZ	Figure 37-1	/	/	
QACCZ0053AF00	LBSHC0007AFZZ	Figure 37-1	/	/	
QACCV0001AGZZ	LBSHC0004AGZZ	Figure 37-2	OLD TYPE BLUE / NEW TYPE BROWN	OLD TYPE BLACK / NEW TYPE BLUE	



(Specifications or wiring diagrams of this model are subject to change for the improvement without prior notice)

Figure 36 SCHEMATIC DIAGRAM

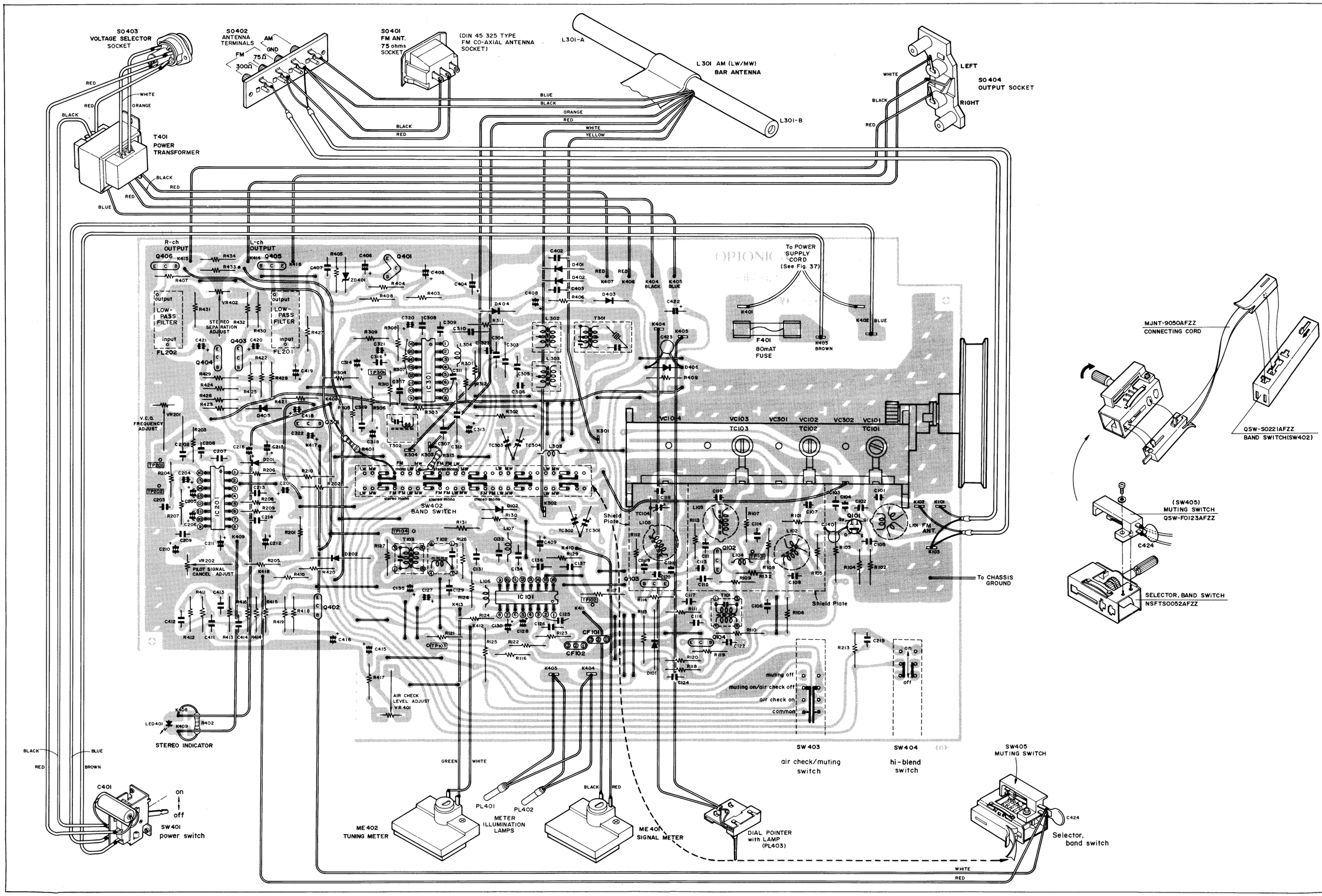


Figure 35 WIRING SIDE OF P.W. BOARD

FM STEREO V.C.O., SEPARATION AND PILOT SIGNAL CANCEL ADJUSTMENT

1) Set the band selector switch (SW402) to "FM stereo" position.
2) Connect FM signal generator, through a dummy resistor of 300 ohms, to the FM antenna terminal of the set.
3) As to setting of the switches, take the same procedures as in the step 3 "FM IF READJUSTMENT AND DISTORTION FACTOR ADJUSTMENT".
4) Set the frequency of FM signal generator to 98 MHz (40 kHz deviation, 400 Hz) and the output to 60 dB (mono signal), and let the set be exactly tuned to such signal.
5) Connect VTVM, through a 3.3 Meg. ohm resistor, to the test point TP201 and a frequency counter to the output terminal of VTVM. (with the earth side connected to the test point TP202).
   Make the test points TP103 and TP104 (earth) of the set be connected (shorted). Rotate the semi-fixed resistor VR201 to adjust so that the frequency counter will read 76.00 kHz ± 76 Hz. (After the adjustment; reset the connection between the test points TP103 and TP104).
6) Connect FM stereo modulator to FM signal generator. At the time, the following should be set; modulation frequency; 1 kHz (L + R; 20 kHz, L − R; 20 kHz, pilot (19 kHz); 6 kHz deviation).
7) Set the frequency of FM signal generator to 98MHz and its output to 60dB, tune the set in such signal so that the tuning meter will indicate the position "center".
   Connect VTVM to the output terminal of the set. Then, make the FM stereo modulator allow generation of only the 19 kHz pilot signal (namely make the main signal be free from modulation) and adjust the semi-fixed resistor VR202 so as to minimize the 19 kHz component leaking to either of right and left channel. Then, make, in turn; the main signal of FM stereo modulator undergo modulation effect. Set the FM stereo modulator so as to cause modulation only in L-channel and consider the output of L-channel as 0dB.
   Adjust semi-fixed resistor VR402 so that the separation becomes maximum (the output leaking to the opposite channel is minimized.)
   Take the above procedures also for checking the separation of R-channel, then, adjust so that the separation of both channel will be equal to each other.

[If without the frequency counter, proceed with the alignment as follows. While receiving a FM stereo signal, turn the VR402 until the P.L.L. will be locked (when it is locked, the stereo indicator will be lit). Then, reversely turn the VR402 halfway and fix it.]

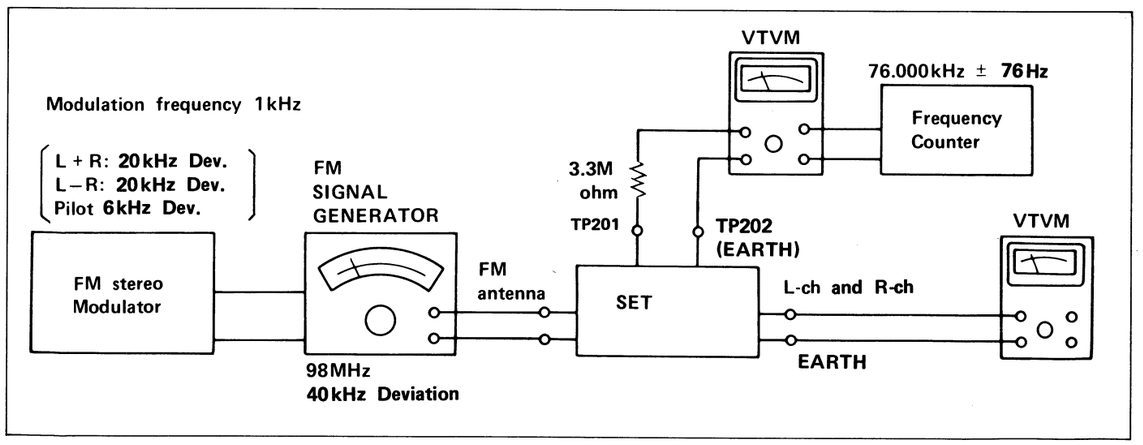
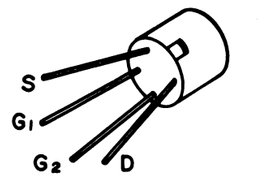
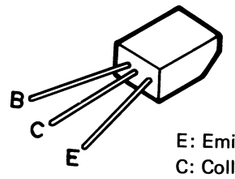


Figure 32 FM STEREO ALIGNMENT EQUIPMENT CONNECTIONS

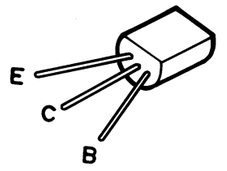


3SK45
S: Source
G1: Gate 1
G2: Gate 2
D: Drain

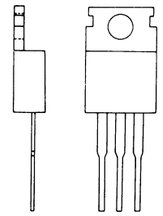


E: Emitter
C: Collector
B: Base

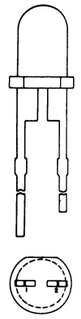
2SC458 (OLD TYPE)
2SC458LG (OLD TYPE)
2SC460
2SC461
2SC535



2SC458 (NEW TYPE)
2SC458LG (NEW TYPE)
2SC1740

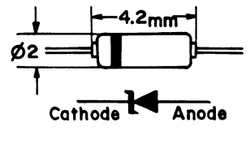


2SC1419

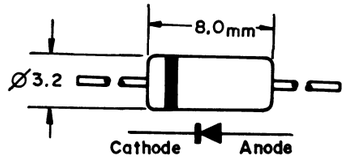


GL32AR

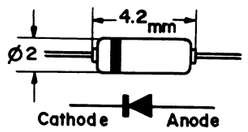
1. ANODE
2. CATHODE



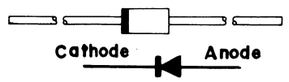
HZ–12 (B)



IN60



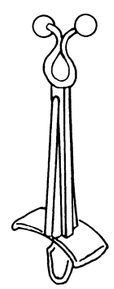
IS2076



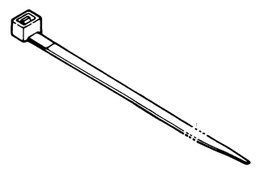
IOEI

Figure 33 TRANSISTORS AND DIODES TYPE

LHLDW1027AGZZ



LHLDW1053AFZZ



LHLDW1075AFZZ

Figure 34 WIRE HOLDER

FM ALIGNMENT

Set the Muting/Air Check Switch (SW403) at "muting off" position.

PROCEDURE NUMBER	TEST STAGE	SIGNAL GENERATOR CONNECTION	SIGNAL GENERATOR FREQUENCY	DIAL POINTER SETTING	SELECTOR SETTING	METER CONNECTION	ADJUSTMENT	REMARKS
1	IF (Note 1)	Connect FM sweep generator, through 6PF capacitor, to the test point TP101. Connect the ground to the shield plate.	Central frequency of ceramic filter (as small as possible)	High end of Dial	Band selector switch (FM mono)	Connect an oscilloscope to the test points TP102 and TP104 (earth)	T101	Rotate the core of T101 to adjust so that the waveform becomes symmetrical in right and left and attains the maximum in height and width (Fig. 29)
2	Detector	Connect FM sweep generator, through 6PF capacitor, to the test point TP101. Connect the ground to the shield plate.	Same as above	Same as above	Same as step 1.	Connect an oscilloscope to the test points TP103 and TP104 (earth)	T102, T103	Rotate the core to adjust so that the waveform (Fig. 30) becomes symmetrical in the upper and lower with the best linearity.
3	Repeat the steps 1 and 2 until no further improvement can be made.							
4	Band Coverage	Connect FM signal generator to the FM antenna terminals. (Keep the input be closed as much as possible)	87.0 MHz (Modulated) as small as possible	Low end of Dial	Band selector switch (FM mono)	Connect VTVM to the test points TP103 and TP104 (earth)	Oscillator Coil L105.	Adjust for maximum output
5		Same as above	109 MHz (Modulated) as small as possible	High end of Dial	Same as step 4	Same as above	Oscillator Trimmer TC104.	Same as above
6	Tracking	Same as above	90 MHz (Modulated) as small as possible	Tuning in 90 MHz	Same as step 4	Same as step 4	Antenna Coil L101 and RF Coil L102 and L103.	Same as step 4
7		Same as above	106 MHz (Modulated) as small as possible	Tuning in 106 MHz	Same as step 4	Same as step 4	Antenna Trimmer TC101 and RF Trimmer TC102 and TC103.	Same as above
8	Repeat the steps 4 to 7 until no further improvement can be made.							
9	After the adjustment, make sure that the tuning meter (ME402) indicates its center for non-signal reception. (This is adjustable by using T102.)							

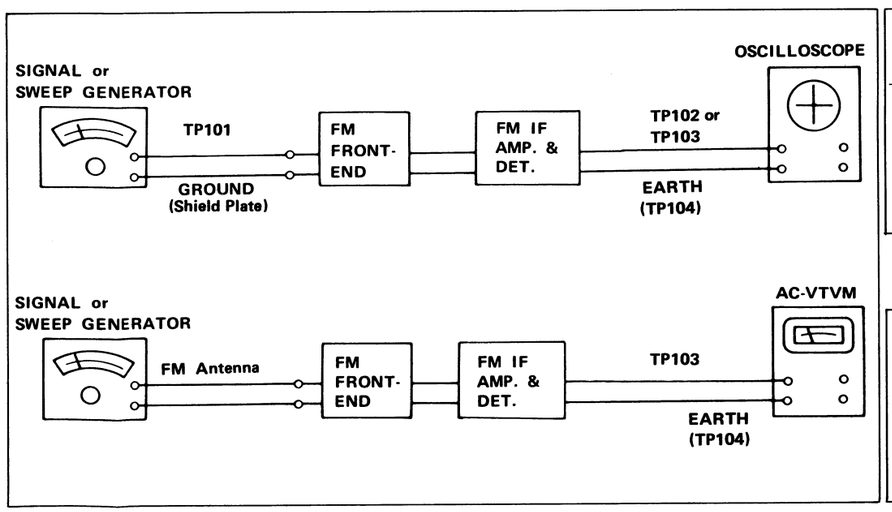


Figure 28 FM ALIGNMENT EQUIPMENT CONNECTIONS

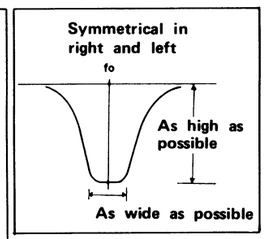


Figure 29 "IF" CURVE

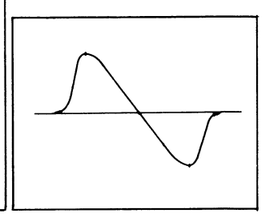


Figure 30 "S" CURVE

Note 1

The ceramic filter used for this set is available in 5 types and each of them is given a color indication to differentiate the central frequency from that of the others, as described below. In the actual use, be sure to make 2 ceramic filters of the same type (the same color) as a pair to put them in the set. When other ceramic filters than that given red color indication (with the central frequency of 10.7MHz) are used, note that with such filters the marker (10.7MHz) of FM sweep generator will be deviated; therefore be sure to cut off the marker at the time of the adjustment.

Central frequency (fo)	D	Black	10.64MHz ± 0.03MHz
	B	Blue	10.67MHz ± 0.03MHz
	A	Red	10.70MHz ± 0.03MHz
	C	Orange	10.73MHz ± 0.03MHz
	E	White	10.76MHz ± 0.03MHz

(2 ceramic filters to be used in a set as a pair should be of the same type (the same color).)

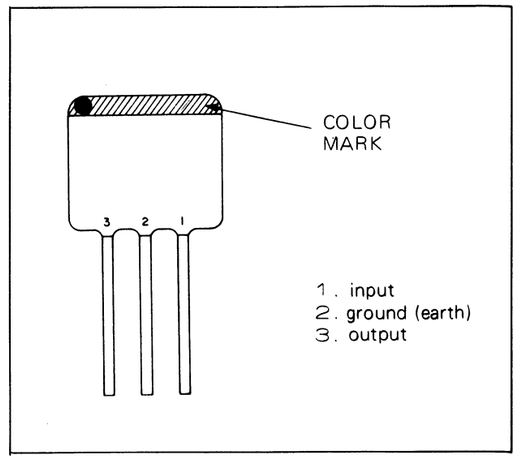


Figure 31

FM IF READJUSTMENT AND DISTORTION FACTOR ADJUSTMENT

1) Set the band selector switch (SW402) to "FM stereo" position.
2) Set the frequency of FM signal generator to 98 MHz (40kHz deviation, 400 Hz), fully close the output and connect such signal to the FM antenna terminal of the set through a dummy resistor of 300 ohms.
3) Set the switches of the set to the respective positions shown below and turn on the power switch.
   [Hi-blend – off, Air Check/Muting – muting off]
4) Keeping the output of FM signal generator be fully closed (that is, with no signal given), rotate the core of T102 to have the pointer of the tuning meter indicate the center (around "98 MHz" position).
5) Adjust the output of FM signal generator to 60 dB, make the set be tuned to this signal so that the tuning meter indicates its center and under the condition, adjust the core of T103 so that the distortion will be minimized.
6) Fully close the output of FM signal generator and make sure the pointer of the tuning meter is at the center.
7) Repeat the steps 1) to 6) until the best point will be found.
8) Connect FM stereo modulator to FM signal generator. At the time, the following should be set: modulation frequency; 1 kHz [modulation degree L+R 20 kHz deviation, L–R 20 kHz deviation, pilot (19 kHz) 6 kHz deviation]. FM signal generator is being set so that the output will be 60 dB with the frequency 98 MHz.
9) Arrange the FM stereo modulator to cause modulation for only the signal at the left channel and finely adjust the T101 so as to provide a minimum distortion. (The same operation is to be made also for the right channel signal.)
10) Fully close the output of FM signal generator (the same as with no signal given) and check that the pointer of tuning meter is not off its center. If otherwise, adjust the T102 to make the pointer be tuned to its center.
11) Repeat the steps 1) to 10) above until you will achieve the best tuning.

ADJUSTMENT OF AIR CHECK CAL.

Produce 98 MHz, 60 dB FM mono signal (75kHz deviation, 400 Hz) by a signal generator to apply it to the antenna of the unit and read the tuner output voltage.
Next, set Air Check/Muting switch to "air check on" position, then the output voltage will vary. Adjust semi-fixed resistor VR401 so that the output voltage with Air check/Muting switch set to "air check on" becomes about 40% (–8 dB), of that with Air Check/Muting switch kept at "air check off".

AM IF ALIGNMENT (MW, LW)

PROCEDURE NUMBER	SWEEP GENERATOR		DIAL POINTER SETTING	SELECTOR SETTING	SCOPE CONNECTION	ADJUSTMENT	REMARKS
	CONNECTION	FREQUENCY					
1	Entwine signal generator output in loop from around antenna coil L301-A.	455 kHz (Central frequency of ceramic filter)	High end of Dial	Band selector switch (MW)	Oscilloscope is connected between [TP301] and [TP104] (earth)	T301 T302	Maximum response at 455 kHz Repeat 2 or 3 times

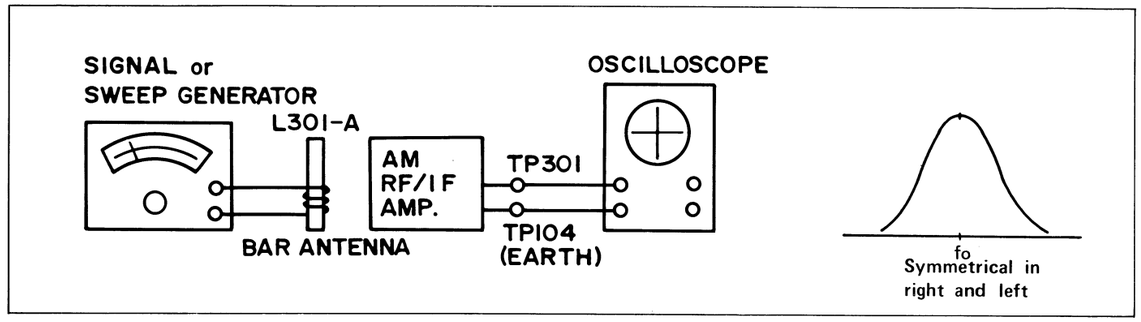


Figure 24 AM IF ALIGNMENT EQUIPMENT CONNECTIONS

MW RF ALIGNMENT

PROCEDURE NUMBER	TEST STAGE	SIGNAL GENERATOR		DIAL POINTER SETTING	SELECTOR SETTING	SCOPE CONNECTION	ADJUSTMENT	REMARKS
		CONNECTION	FREQUENCY					
1	Band Coverage	Connect AM signal generator to the loop antenna and place this assembly at near the bar antenna coil L301-A. (Keep the input be closed as much as possible).	515 kHz Modulated	Low end of Dial	Band selector switch (MW)	Oscilloscope is connected between [TP301] and [TP104] (earth)	Oscillator Coil L303.	Adjust for maximum output
2		Same as above	1650 kHz Modulated	High end of Dial	Same as above	Same as above	Oscillator Trimmer TC304.	Same as above. Repeat steps 1 and 2, 2 or 3 times.
3	Tracking	Same as above	1400 kHz Modulated	Tuning in 1400 kHz	Same as above	Same as step 1	Antenna Trimmer TC301.	Same as step 1
4		Same as above	600 kHz Modulated	Tuning in 600 kHz	Same as above	Same as step 1	Antenna Coil L301-A.	Same as above. Repeat steps 3 and 4, 2 or 3 times.

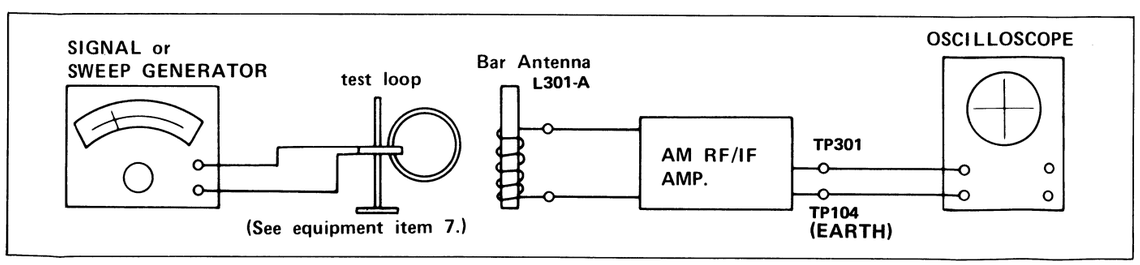


Figure 25 MW RF ALIGNMENT EQUIPMENT CONNECTIONS

LW RF ALIGNMENT

PROCEDURE NUMBER	TEST STAGE	SIGNAL GENERATOR		DIAL POINTER SETTING	SELECTOR SETTING	SCOPE CONNECTION	ADJUSTMENT	REMARKS
		CONNECTION	FREQUENCY					
1	Band Coverage	Connect AM signal generator to the loop antenna and place this assembly at near the bar antenna coil L301-B. (Keep the input be closed as much as possible)	145kHz Modulated	Low end of dial	Band selector switch (LW)	Oscilloscope is connected between [TP301] and [TP104] (earth).	Oscillator Coil L302.	Adjust for maximum output.
2		Same as above.	385kHz Modulated	High end of dial	Same as above.	Same as above	Oscillator Trimmer TC303.	Same as above. Repeat steps 1 and 2, 2 or 3 times.
3	Tracking	Same as above.	340kHz Modulated	Tuning in 340kHz	Same as above.	Same as step 1	Antenna Trimmer TC302.	Same as step 1
4		Same as above.	170kHz Modulated	Tuning in 170kHz	Same as above.	Same as step 1	Antenna Coil L301-B.	Same as above. Repeat steps 3 and 4, 2 or 3 times.

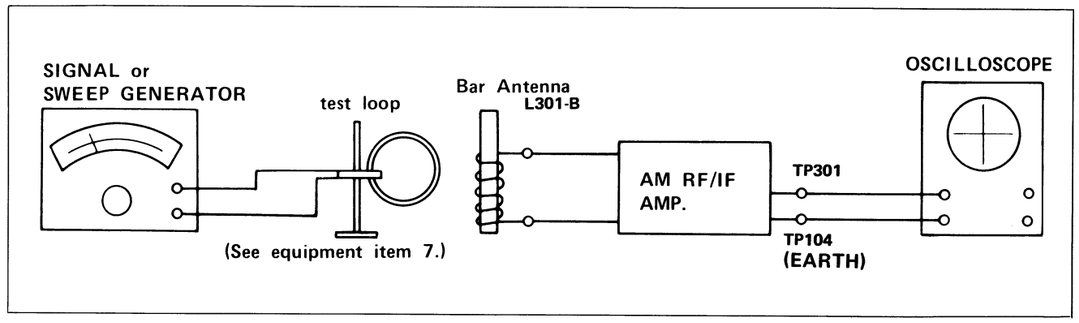


Figure 26 LW RF ALIGNMENT EQUIPMENT CONNECTIONS

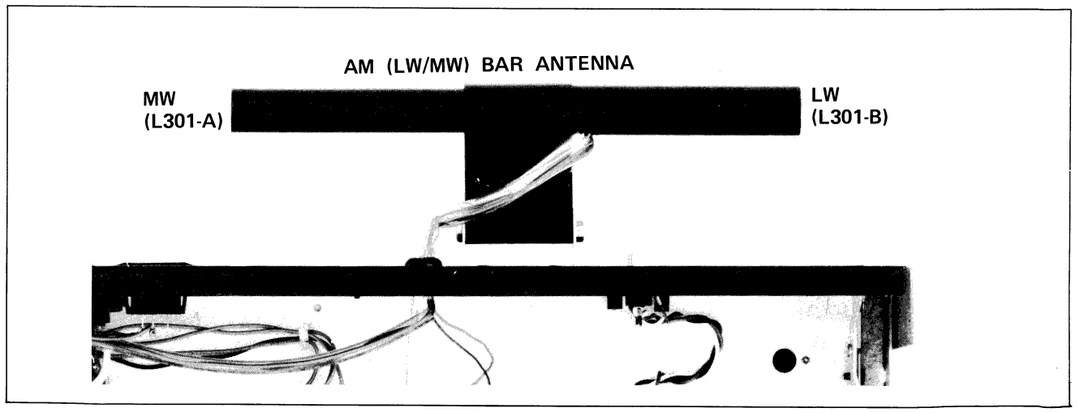


Figure 27 AM (LW/MW) ANTENNA

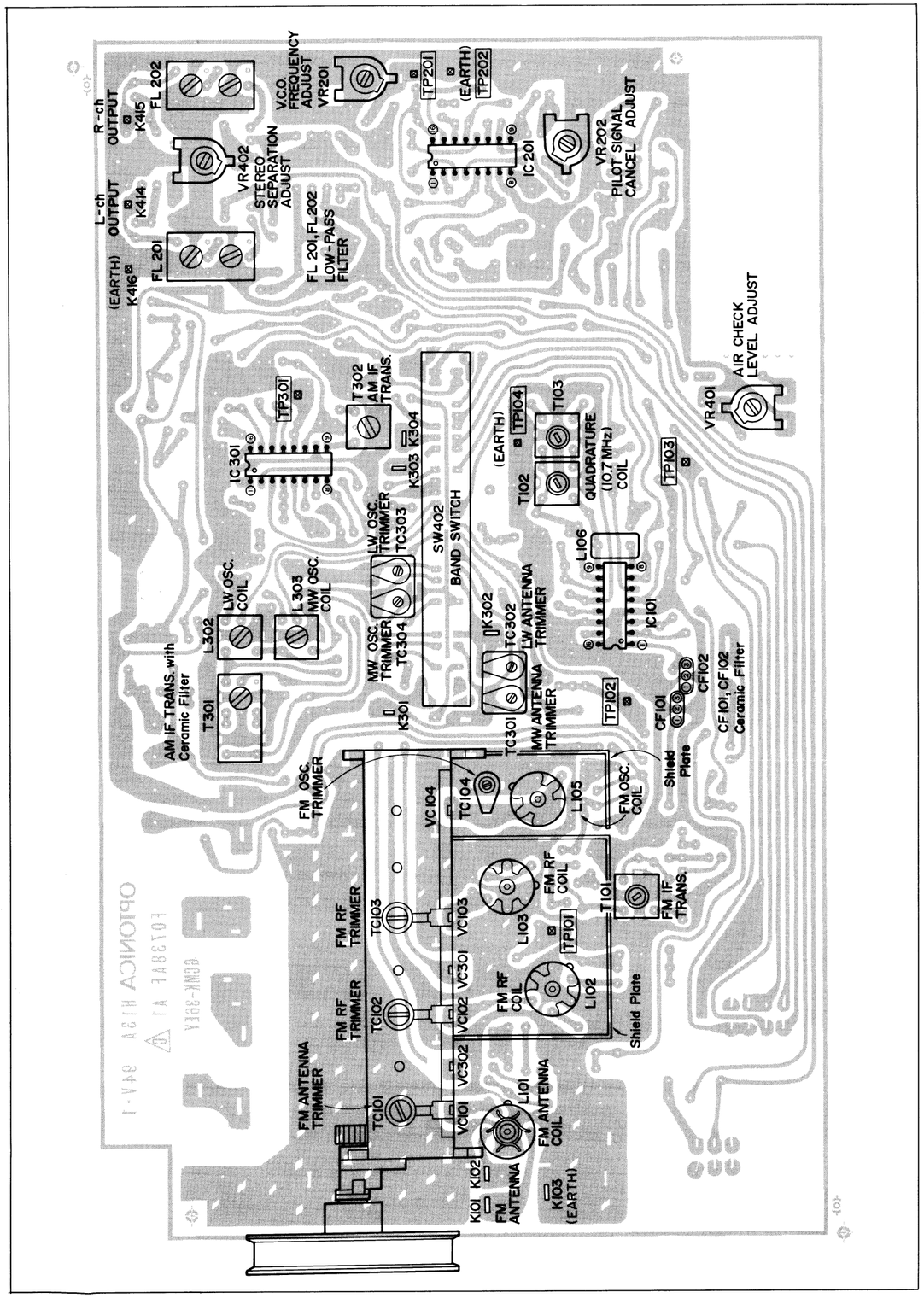


Figure 22 ALIGNMENT POINTS OF P.W. BOARD

ALIGNMENT INSTRUCTIONS

Alignment is an exacting procedure and should be undertaken only when necessary. If alignment of AM and FM is required, either section may be done first. The FM stereo section, however, should be done only if the FM monaural section is properly adjusted.

REQUIRED EQUIPMENT

1. Signal generator with a frequency range of 145kHz to 1,650kHz; AM (LW, MW)
2. Signal generator with a frequency range of 86.1MHz to 109.2MHz; FM
3. Vacuum tube voltmeter (AC-VTVM)
4. Sweep signal generator with a sweep range of at least 500kHz and center frequency of 10.7MHz with at least a 10.7MHz marker may be used. (For FM)
5. Sweep signal generator with a sweep range of at least 50kHz and center frequency of 455kHz with at least a 455kHz marker may be used. (For AM)
6. Oscilloscope with a wide range amplifier of approximately 100kHz.
7. Test loops, a coil of any size wire, one turn or more; AM (LW, MW).
8. Vacuum tube voltmeter (DC-VTVM)
9. FM stereo signal generator.
10. Audio signal generator with a frequency range of 20Hz to 100kHz.
11. Frequency counter with a frequency range of approximately 100kHz.

Notes:

Allow the set at least five minutes to warm up before attempting alignment. During alignment keep the signal generator output at the lowest level that will maintain a usable output from the set.

For the adjustment of stereo separation, the FM stereo generator output is usually 1,000μV. Incorrect grounding to the metal chassis may pick up an unwanted 10.7MHz signal from the final IF stage, which will cause a regenerative sweep response on the sweep curve and result in misalignment.

Therefore always connect a ground to point.

Ground connection of signal generator:	Chassis ground
Generator modulation (AM):	30%, 400Hz
Generator modulation (FM):	40kHz, 400Hz
Generator modulation (FM stereo):	Ch. L. or Ch. R. 40kHz, 1,000Hz Mod.

THE INSTRUCTION OF FM FREQUENCY ADJUSTMENT

In order to comply with Pfg. Nr. 358/1970, please fix the low end of dial frequency (87.5MHz) and high end of dial frequency (107.9MHz) on FM band, by adjusting oscillation coil (L105) and oscillation trimmer (TC104), repectively, as illustrated in Figure 23.

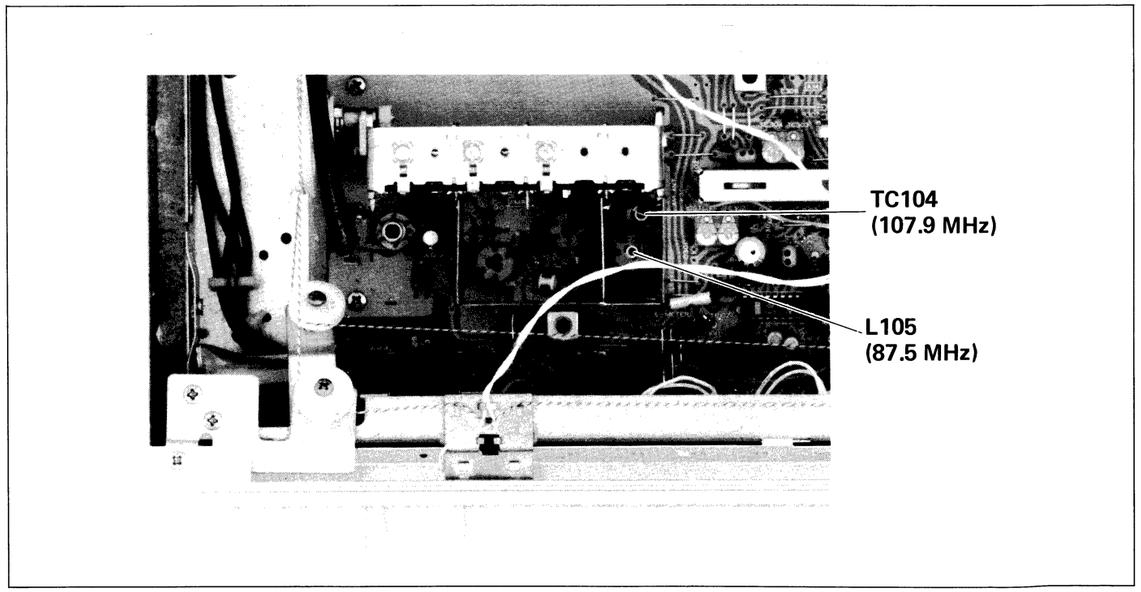


Figure 23

AM SECTION

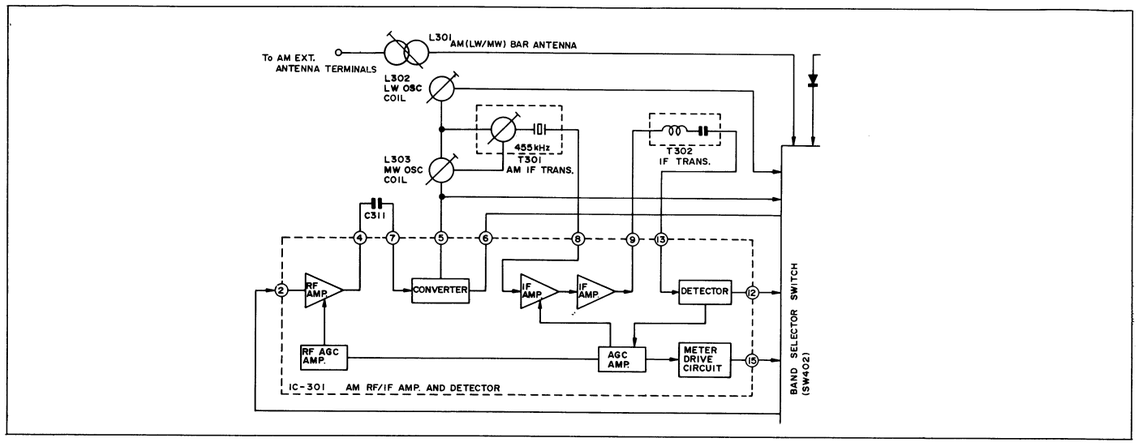


Figure 19 BLOCK DIAGRAM OF IC301

Figure 19 is a block diagram of IC301. The coil L301 is AM ferrite bar antenna and it serves as antenna tuning circuit. Being received by the coil L301, MW and LW broadcast signals are applied to the terminal (2) of the integrated circuit IC301 to be amplified by RF amplifier and then be supplied to the converter via the capacitor C311. L302 and L303 are oscillation coils for MW and LW local oscillation circuit. MW and LW broadcast signals are thus converted to 455kHz IF signal by the converter to be applied to the transformer T301 which works as intermediate frequency selection element including ceramic filter and the signal will further be amplified by 1st and 2nd IF amplifiers to be applied to the transformer T302. Then the signal is finally detected by the detector circuit and it will be output at the terminal (12). This IC301 also includes signal meter drive circuit which enables easier tuning and the output at the terminal (15) is connected to the signal meter (ME401).

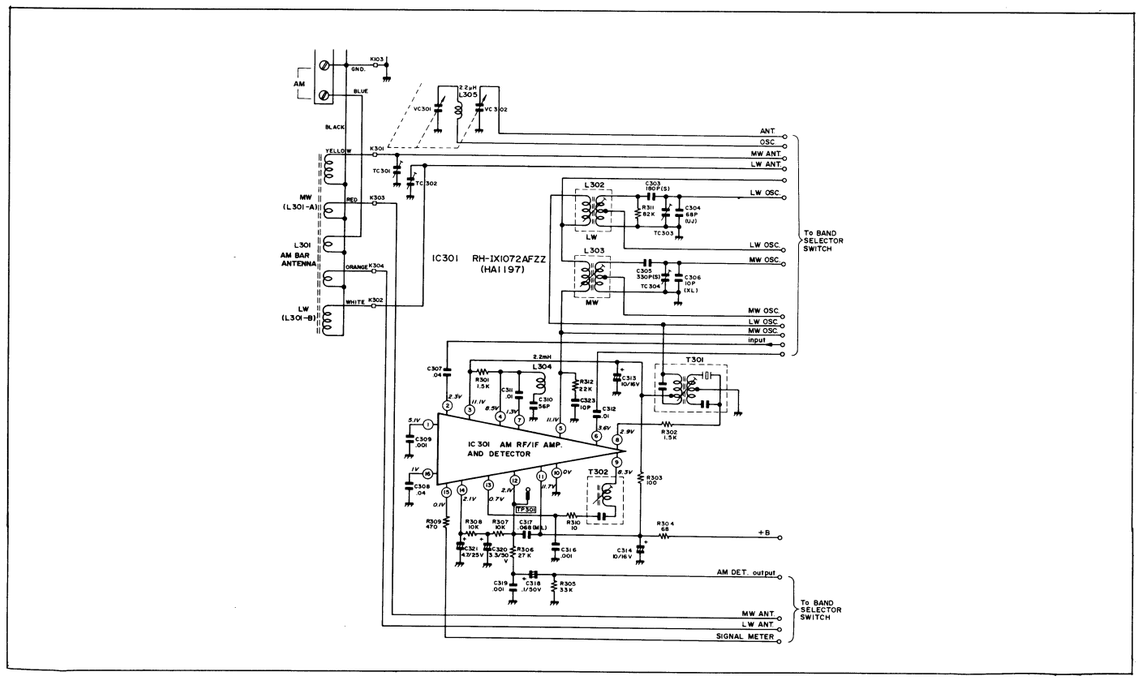


Figure 20 AM CIRCUIT

HIGH-BLEND CIRCUIT

The high-blend circuit consists of high-blend switch and capacitor C219 as shown in the figure 21. In the reception of stereo broadcast, noises possibly caused in both channels are reverse in phase to each other. The high-blend circuit is to offset these two noises each other thus increasing tone quality. The high-blend circuit functions when the high-blend switch is set to "on" position. With the high-blend switch set to "on", however, the separation in high-frequency band becomes a little decreased.

AUDIO MUTING CIRCUIT

The audio muting circuit consists of transistors Q405 and Q406, diodes D403, D404, D405 and D406, resistors R406, R407, R408, R409 and R423 and capacitors C408, C418 and C422 and it is able to reduce possible shock noises caused when the power switch (SW401) is turned off.
When the set is normally operating, the base voltage of the transistors Q405 and Q406 is of about –3.8 V and these transistors Q405 and Q406 are keeping open condition (cut-off). However, when the power switch is turned off, in no time the base voltage of the transistors Q405 and Q406 becomes positive value since there is no rectification caused at the diodes D403, D404 and D406 – this results in that the transistors Q405 and Q406 go to close condition (turned-on). Thus, shock noises having been generated at the preceeding stage will escape to the earth so that there will be no shock noises available at the output terminal.

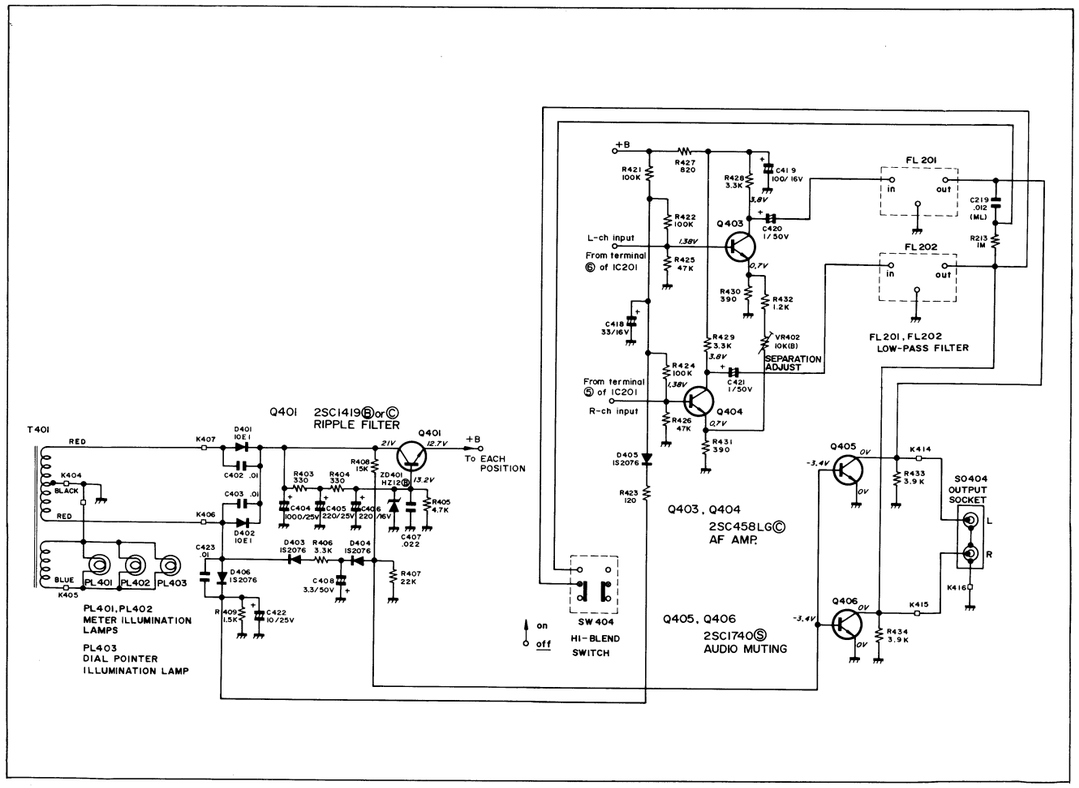


Figure 21

POWER SUPPLY CIRCUIT

In dealing with +B power supply, the power voltage is full-wave rectified by diodes D401 and D402 to be supplied to each section. Diode ZD401 is zener diode to be used for voltage regulation and the zener voltage is about 13.2 V. Transistor Q401 is to remove ripples from the rectification current.

FM STEREO DEMODULATOR SECTION

1) Features of P.L.L. stereo demodulator circuit with pilot cancell circuit

This set incorporates a stereo demodulator circuit that comprises IC's with the P.L.L. (Phase Locked Loop) system applied. The P.L.L. stereo demodulator circuit is provided with such characteristics as mentioned below.

In order to demodulate stereo composite signals, it is necessary to take a 19kHz pilot signal out of the stereo composite signals and to make it a 38kHz signal.

Most of the conventional methods to obtain such a 38kHz signal are frequency doubling ones which utilize a nonlinearity of the elements. Compared with the conventional type, the recently developed IC-ed demodulator provides more sufficient separation effects. However, since it also requires 2 or 3 coils like the conventional one, if even one of them is dislocated from the initially adjusted point due to a secular change the separation effects will be deteriorated. Moreover there is such a contradiction that the more the efficiencies of the coils are increased enough to withstand the outer pulse signals like automobil ignition noises, the more the coils suffer secular changes.

To eliminate such disadvantages as above, P.L.L. system is employed in the method to make a 38kHz signal using a 19kHz pilot signal.

The P.L.L. system stereo demodulator gives such three merits as:

(1) Since the phases of a pilot signal and a 38kHz signal are automatically made the same with each other, the deterioration of separation effect is strongly minimized.

(2) Since only one of variable resistor, being newly employed, plays the role of 2 to 3 pieces of conventional coils, troubles of the parts due to secular changes are decreased. In addition, even if this variable resistor is slightly dislocated, the separation effect will never be deteriorated because of the merit as mentioned in 1 by which the automatic phase adjustment is assured.

(3) Compared with the conventional one, the P.L.L. system demodulator shows a more noise withstanding characteristic since it has such performances as the selection of frequencies and the continuity of oscillation frequencies (short-time memory) thus assuring a stable stereo demodulation.

In addition to the above, this stereo demodulator IC has the following outstanding features thereby to ensure a much better tone quality in stereo reception.

(4) Thanks to the pilot signal canceller circuit built in the set, there develops no 19 kHz signal component mixing in the demodulator's output signal. This will give rise to another advantage that although, in conventional two-pole type low-pass filter, the attenuation characteristic is of 19 kHz, that of this set can be set at a value higher than 19 kHz at its pole, namely at the point of 24 kHz: the result is that frequency component of the stereo signal can be decoded up to higher than 15 kHz without any attenuation, thereby assuring more improved frequency and phase characteristics in the high-frequency range.
Besides, since it is so designed with this set that the pilot signal is cancelled before reaching the switching decoder of the demodulator, there will be a remarkable reduction of such an incovenience found in the conventional set that 19 kHz pilot signal may be mixed in the composite signal at the time of decoding.

(5) Beat to occur due to a high-frequency component of the stereo signal which has so far been found in the P.L.L. multiplex system is greatly suppressed; the low-pass filter in the P.L.L. circuit is improved in its structure so that the signal frequency caused by the V.C.O. (Voltage Controlled Oscillator) doesn't tend to suffer a modulation by the beat signal.
For instance, it is in this set that 1 kHz beat component associated with the stereo signal of 10 kHz is one-fifth the value found in the conventional set, in terms of the distortion level.

(6) The 100% NFB circuit included in the decoder circuit assures a more stable operation of the whole circuitry to provide a strongly lowered distortion factor.

(7) Finally as to the signal-to-noise ratio, it is kept to the very satisfied value by much consideration paid to the circuit designing.

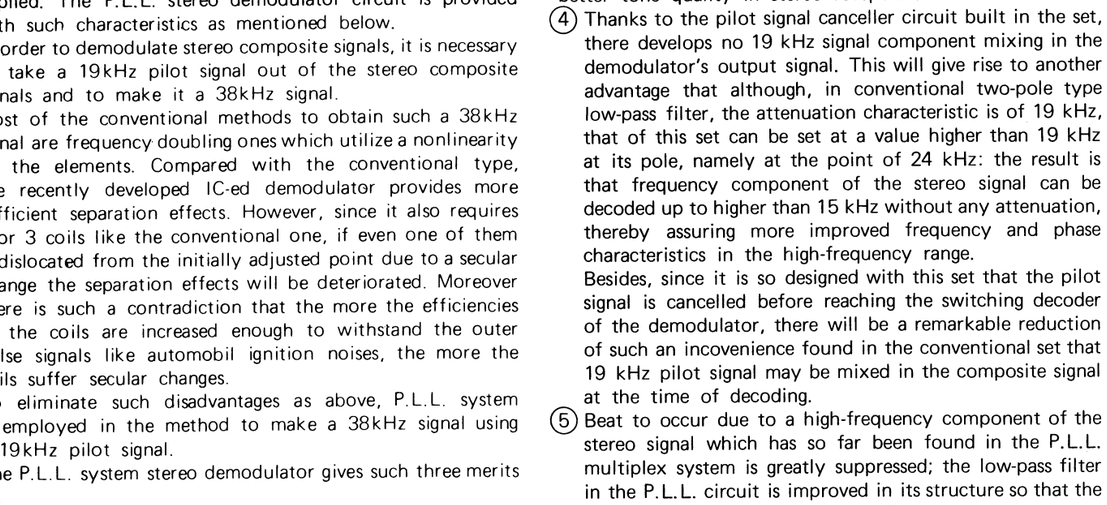


Figure 15 BLOCK DIAGRAM OF IC201

2) FM stereo demodulator circuit

IC201 is an integrated circuit for P.L.L. stereo demodulation with pilot cancel circuit and its block diagram is as shown in Figure 15.

V.C.O. free-running frequency is to be adjusted to 76kHz by adjusting semi-fixed resistor VR201 (3K ohms). TP201 is the test point for frequency observation. (See the paragraph Adjustment' described later.)

During AM (LW/MW) reception, +B voltage is supplied to the terminal (16) of IC201 through diode D201 and resistor R202 so that oscillation frequency of V.C. O. will be stopped.

Semi-fixed resistor VR402 (10K ohms) aim at the adjustment of stereo separation and with this resistor it is possible to minimize crosstalk to the opposite channel.

Meanwhile, semi-fixed resistor VR202 (100K ohms) is used to adjust and cancel the pilot signal and this resistor allows you to minimize carrier leaking to either right channel or left channel. For converting stereo signals into monaural ones, there is provided such a design that a current (for LED driving) running in the terminal (8) of IC201 is cut off to enable a monaural reception.

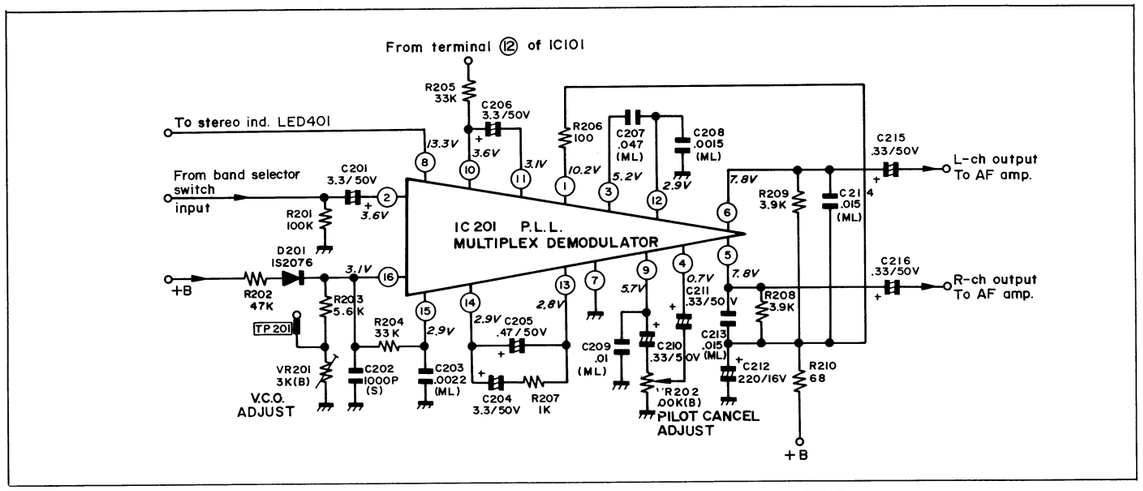


Figure 16 FM STEREO DEMODULATOR CIRCUIT

AIR CHECK CALIBRATION CIRCUIT

This circuit is to make appropriate the recording level in advance when recording FM broadcast into the tape recorder. The circuit shown in Figure 17 hereof is CR type oscillator circuit to be used for the air check calibration (about 400Hz). When the air check/muting switch (SW403) located at the front panel is set to the position "air check on", the air check calibrator circuit begins to operate and oscillation voltage thus produced by the air check calibrator circuit will appear as air check signal at the output terminal (SO404) located at the rear of the set. The air check signal level is set to 40% (–8dB) of the output voltage obtained when the tuner receives FM broadcast signal (modulation, 75kHz deviation) and this level voltage appears at the output terminal of the rear panel through the air check oscillator circuit. VR401 is semi-fixed resistor to be used for adjusting the air check signal level. How to record FM broadcast using the air check calibration system is described below.

Set the air check/muting switch to "air check on" position, put the tape recorder in record mode, apply air check signal to the tape recorder and adjust the record level so that the record level meter of tape recorder indicates "0 VU" (Figure 18). After that, set the air check/muting switch to "air check off" position and proceed with recording FM broadcast.

[Note]

In the case of AM(LW/MW) reception, in other words, when the band selector switch is kept to the position LW and MW, air check level signal does not appear at the output terminal located at the rear of the set since the air check calibrator is not functioning at the time.

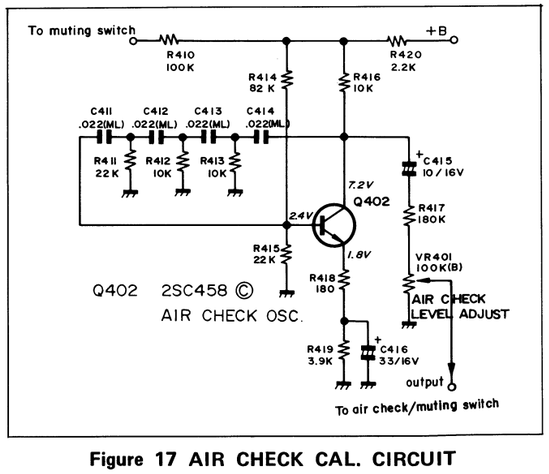


Figure 17 AIR CHECK CAL. CIRCUIT

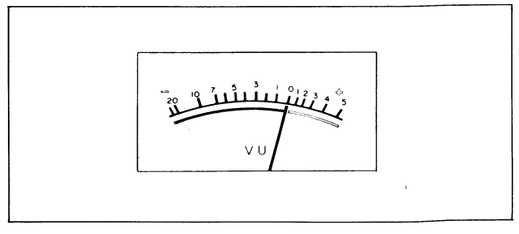


Figure 18 "0 VU"

FM DETECTION SECTIONS (Quadrature Detector Circuit)

FM Detector Circuit
This unit employs 'Quadrature Detector' based on newly developed IC (Integrated Circuit), which is substituted for ratio detector and Foster-Seeley's detector that have been so far used. The basic structure of quadrature detector circuit is as shown in Figure 8.

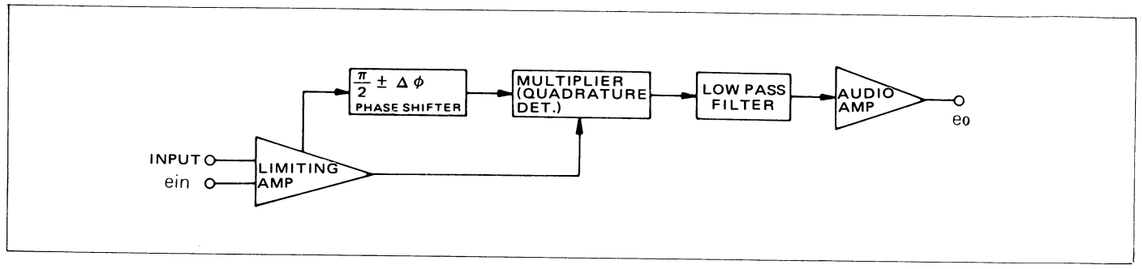


Figure 8 BASIC STRUCTURE OF QUADRATURE DETECTOR CIRCUIT

With this detection system, the multiplier (quadrature detector) circuit receives two types of input signals, one is the signal which has been amplified by the limiting amplifier and another which has passed through the phase shift circuit (about $\pi/2$). Thus, the quadrature detector circuit produces demodulation signal.
The term 'quadrature' is resulted from that the phase difference between these two signal is $\pi/2$. The multiplier consists of doubly balance circuit as shown in the following circuit drawing. Phase characteristic of the phase shift circuit is as shown in Figure 10.
This circuit is featured by.

(1) Good linearity and low distortion.
(2) Operates on small signal and less higher harmonics.
(3) Wide-band detection of as much as 1.0MHz.
Therefore, this circuit assures low distortion even with the overmodulation of more than 100% thereby reproducing high quality sound.
Actually saying, the detecting circuit ST-1616H/HB uses L106 as phase-shift coil. T102 and T103 are 10.7MHz tuning quadrature coil.
Detection output appears at the terminal (6) of IC101 and it is supplied to the terminal (2) of P.L.L. multiplex integrated circuit IC201.

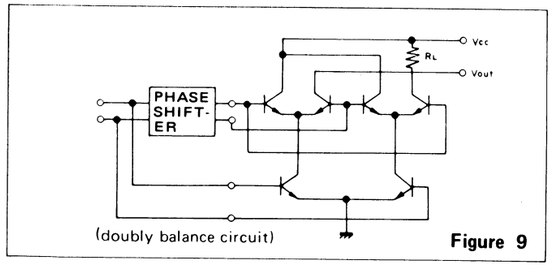


Figure 9

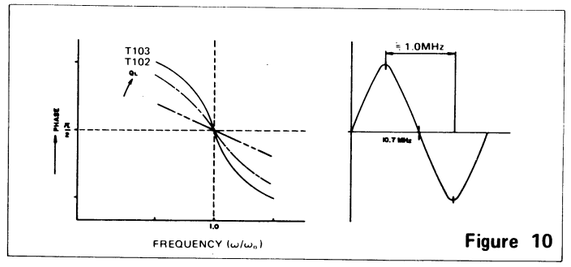


Figure 10

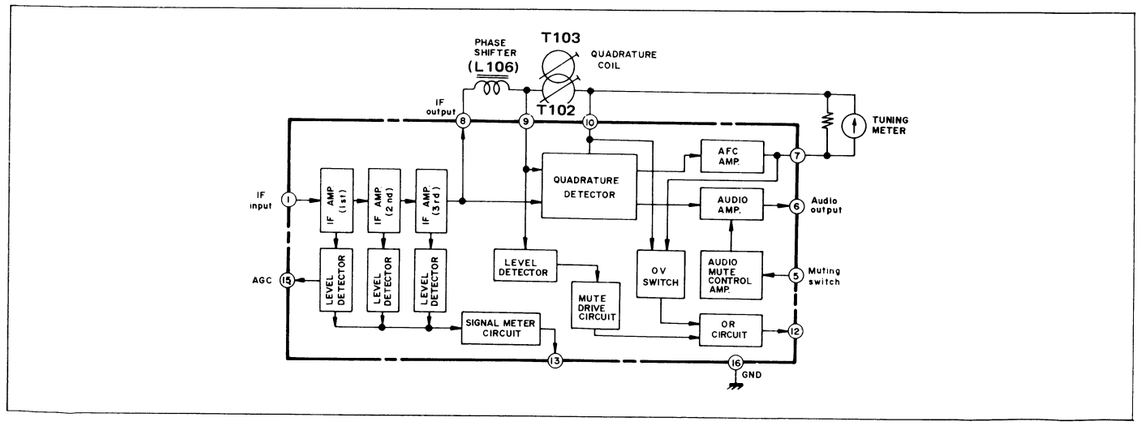


Figure 11 BLOCK DIAGRAM OF IC101

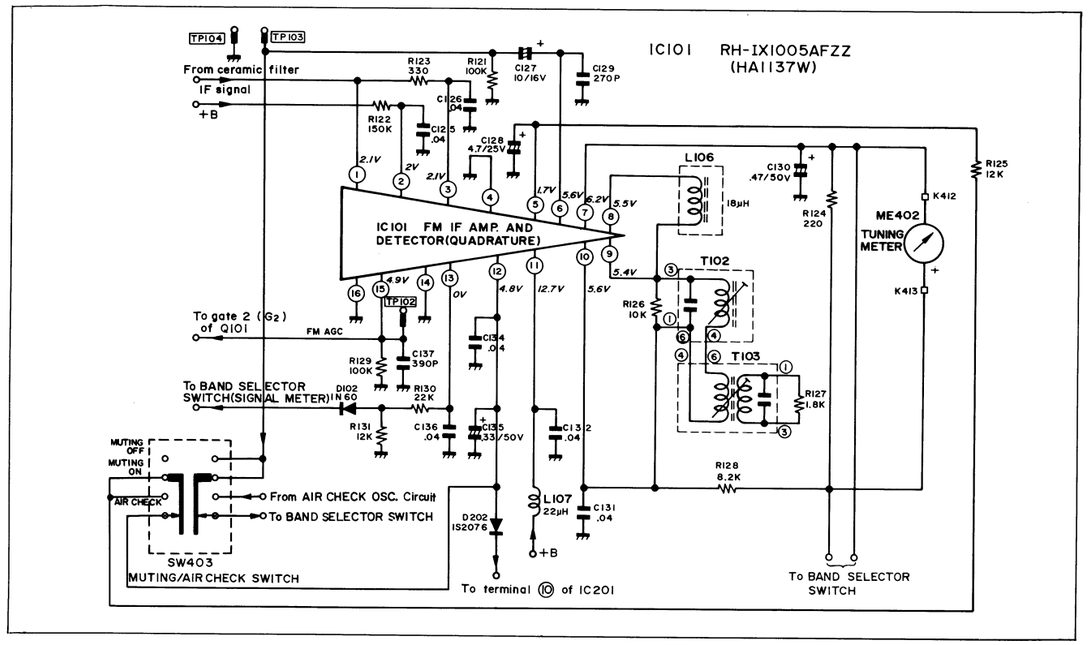


Figure 12 FM DETECTOR (QUADRATURE) CIRCUIT AND FM MUTING CIRCUIT

FM MUTING CIRCUIT

In ST-1616H/ST-1616HB, IC101 incorporates a muting circuit and this circuit is so designed that if FM input signal to the antenna terminal becomes about 14dB when the muting/air check switch (SW403) is kept at "muting on", the muting effect is cancelled and thus the signal can appear at the output without undergoing muting. The signal which serves to cancel this muting effect is produced based upon bias voltage appearing at the terminal (12) of IC101: this bias voltage is to determine the muting width to approx. 200 kHz. The signal thus created is passed on to the muting input circuit at the terminal (5) of IC101, via the muting/air check switch (SW403). In this way, the FM muting circuit becomes able to function. The signal to cancel the muting will be applied to the terminal (10) of the P.L.L. stereo multiplex demodulator IC201 to be forced to mono-operation. Figure 13 shows the output voltage of the terminal (12) of IC101.

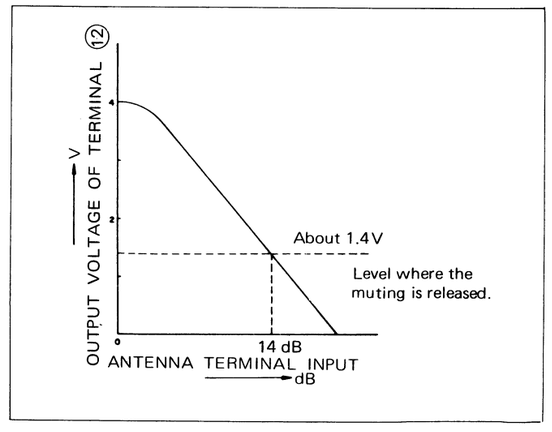


Figure 13

LOW-PASS FILTER

FL201 and FL202 are low-pass filters to remove carrier signals (19 kHz and 38 kHz) leaking from the P.L.L. stereo multiplex demodulator IC201.
The characteristic is as shown in the figure 14.

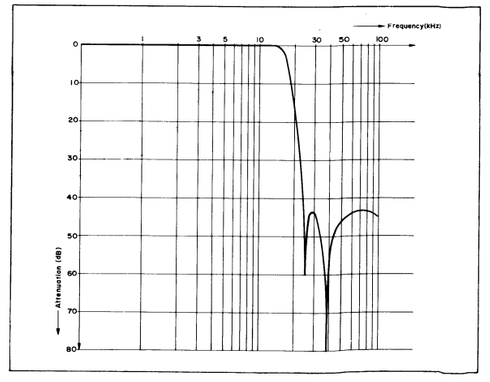


Figure 14

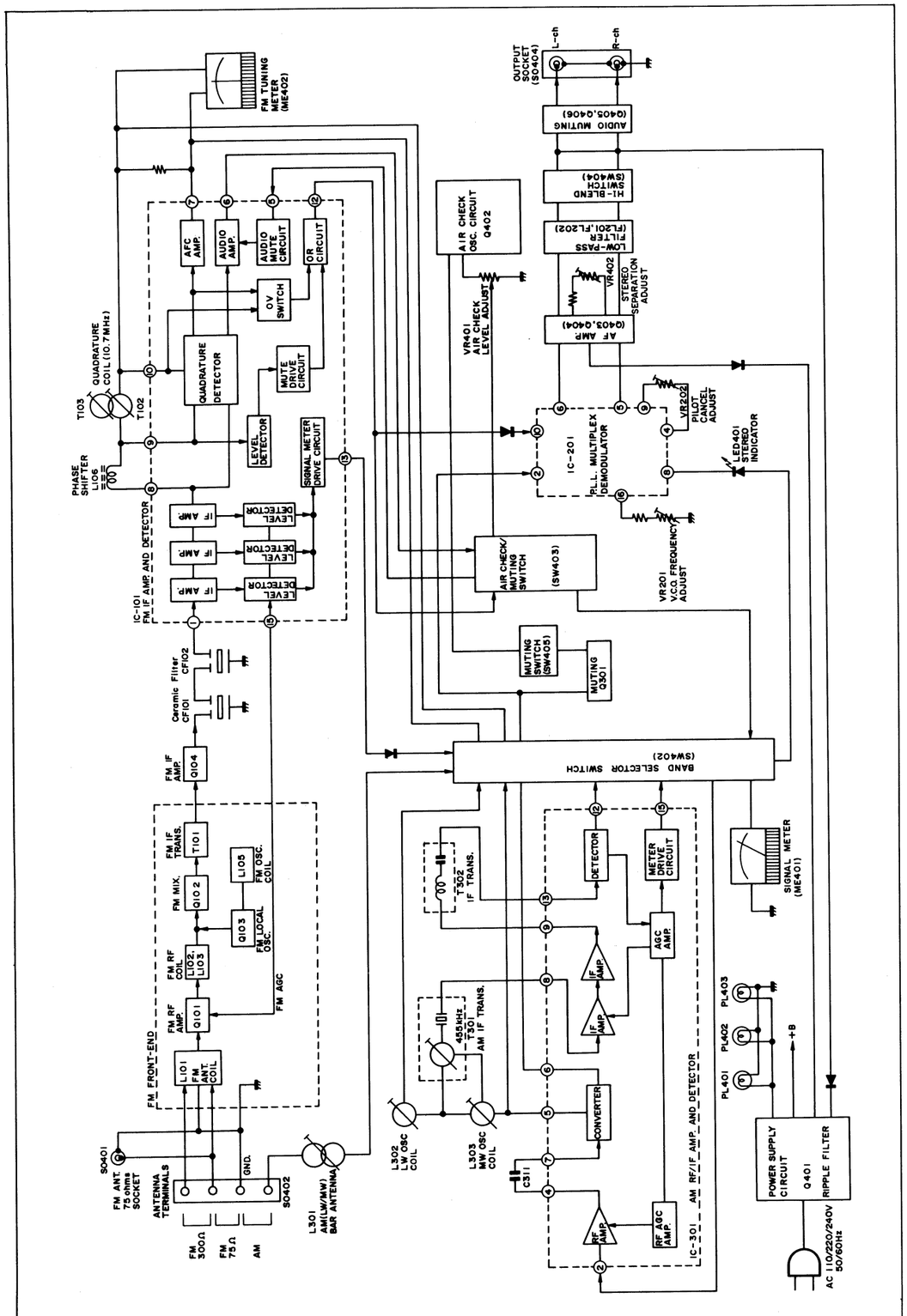


Figure 5 BLOCK DIAGRAM

CIRCUIT DESCRIPTION

FM RF SECTION

FM antenna input circuit has two input terminals (75 ohms and 300 ohms). The 75 ohms input terminal is used when FM antenna is connected to the unit by using a coaxial cable. The 300 ohms input terminal is used when FM antenna is connected to the unit by using a balanced feeder. Figure 6 shows FM Front- End circuit. The front-end section consists of 1 FET (dual-gate, MOS type) and 2 transistors. Transistor Q101 is FET and its function is nearly the same as of vacuum tube. Due to the adoption of FET, crossmodulation characteristic and spurious characteristic are remarkably improved compared with conventional transistor type. (Sharp-made ones).

It is so devised that AGC voltage is applied to the gate 2 (G_2) of FET Q101 of FM Front-End circuit.....this results in that when input signal to FM antenna is strong, amplification degree of FET Q101 is lowered so as to stabilize FM reception. The voltage applied to the gate 2 (G_2) of FET Q101 is at the level of about 4.4 V when the antenna is receiving no input signal.

The voltage is decreased as the input signal to the antenna is increased and it becomes at the level of about less than 1 V when the input signal to the antenna is of 100 dB.

Therefore, the amplification degree of FET Q101 is attenuated by more than about 30 dB.

FET Q101 is FM radio frequency amplifier. Transistor Q102 works as frequency mixer, in which radio frequency signal coming from the FET Q101 and local oscillation frequency coming from the transistor Q103 are mixed to produce 10.7 MHz IF signal which will enter IF tuning transformer T101. The transistor Q103 is for the local oscillation and it applies oscillation voltage to the base of transistor Q102 via capacitor C113 (1pF).

Therefore, coil L101 is for antenna tuning, coils L102 and L103 are for FM RF amplification and tuning and coil L105 is for local oscillation.

Meanwhile, during MW and LW broadcast reception, it is so designed that +B voltage is applied to the emitter of the transistor Q103 via the diode D101 and resistor R116 to stop the oscillation.

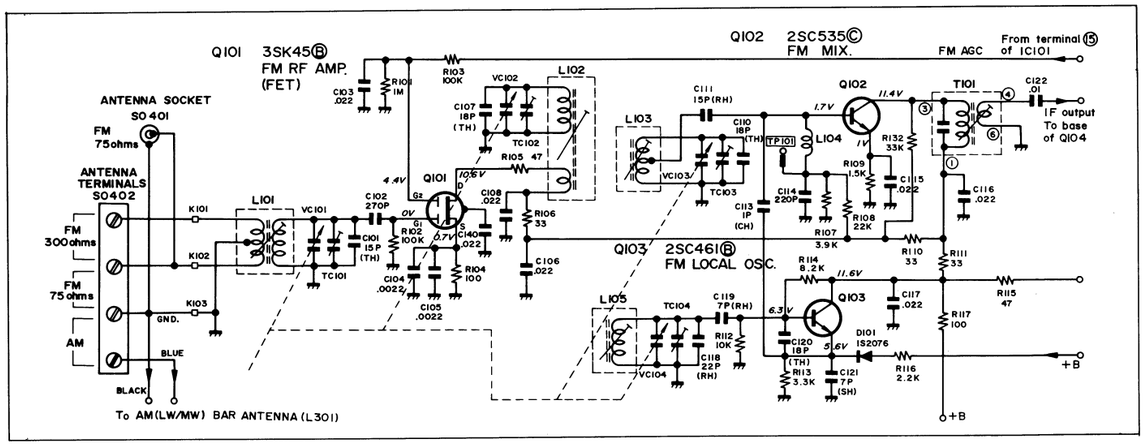


Figure 6 FM FRONT-END CIRCUIT

FM AGC

FM AGC voltage is developed at terminal (15) of IC101, and is applied to the gate 2 (G_2) of FET Q101 through resistor R103.

The AGC voltage is developed in IC101 as delayed AGC voltage, and the AGC starts to operate when antenna input reaches approx. 60 dB and thus a voltage at terminal (15) of IC101 starts to drop.

FM IF SECTION

FM IF section consists of 1 IC (integrated circuit), 1 transistor and 2 ceramic filters. Transistor Q104 is FM IF amplification transistor, which is to amplify IF signal which has been converted into 10.7 MHz signal at FM front end section. This 10.7 MHz IF signal is given a higher selectivity since it runs through the concentrated selective elements, that is, ceramic filters CF101 and CF102. These filters function to amplify IF (intermediate frequency) signals giving no distortion and to assure a necessary selectivity. The IF signal is further supplied to the terminal (1) of IC101, in which the gain of this signal is increased by about 66 dB by the three-stage differential amplifier thus being subjected to an appropriate limiter function.

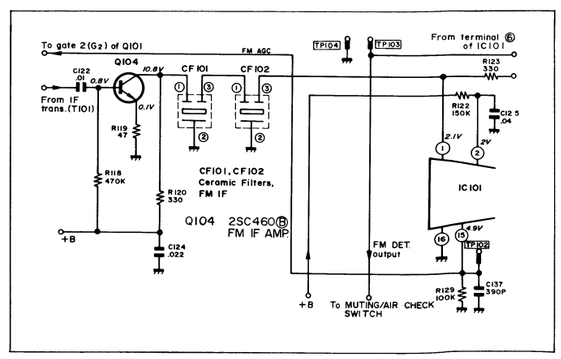


Figure 7 FM IF CIRCUIT

DIAL CORD STRINGING

1) Setting of the dial cord:

(1) Turn the drum fully clockwise (at the highest frequency position).

(2) Put a hook of the spring on the central hole of the drum.

(3) Then proceed with stringing in the numerical order from ① to ⑧ At this work, while holding a hand at the position ⑥ to temporarily fix a dial string, wind the string on the drum by 1-½ turns at the position ⑦ (which is an extention of the string wound at the position ⑥) and bring it through the position ⑧ . Then release a hand from the position ⑥ and thus the stringing is completed.

2) Setting of the pointer:

(1) Turn the tuning shaft fully counterclockwise (at the lowest frequency position).

(2) Align the pointer to the center of LED (stereo indicator) (zero point) of the dial scale plate. (See Fig. 2–1.)

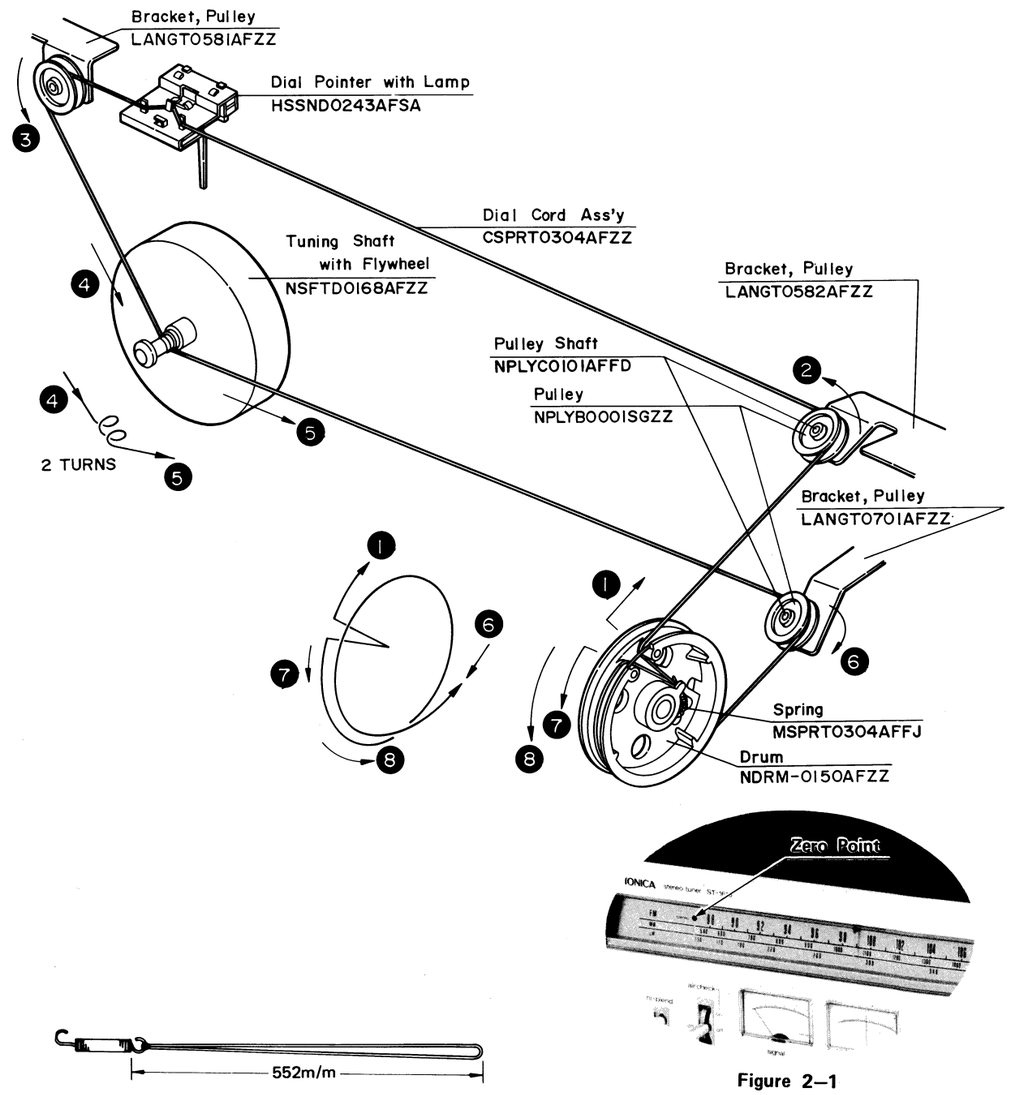
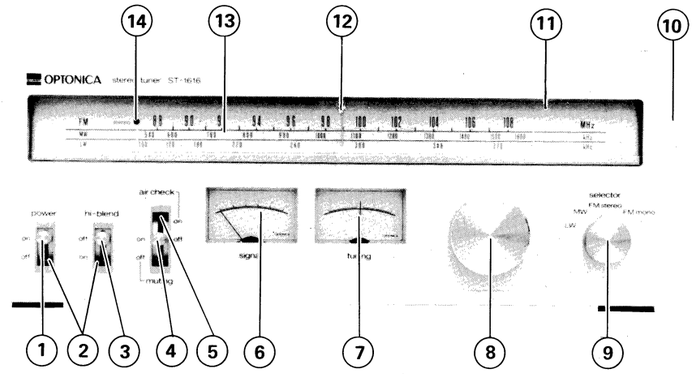


Figure 2–1

Figure 2 DIAL CORD STRINGING

FRONT PARTS LAYOUT

(PHOTO: ST-1616H)

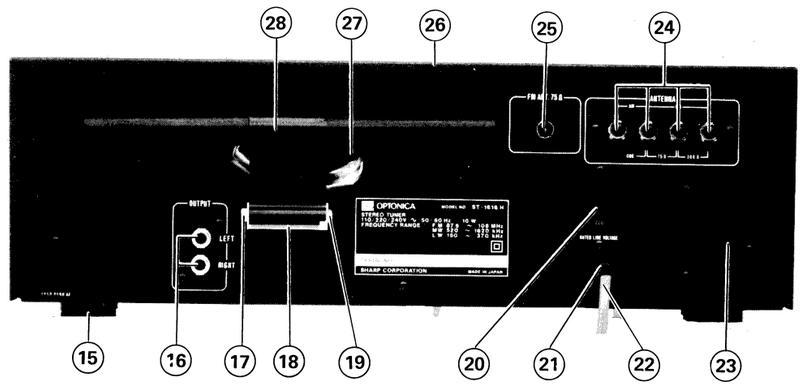


① Power Switch Knob (ST-1616H JKNBP0070AFSA, ST-1616HB JKNBP0070AFSC)
② Guide (Small), Lever Switch (ST-1616H GCOVA1076AFSC, ST-1616HB GCOVA1076AFSB)
③ Hi-blend Switch Knob (ST-1616H JKNBP0070AFSA, ST-1616HB JKNBP0070AFSC)
④ Air Check/Muting Switch Knob (ST-1616H JKNBP0070AFSA, ST-1616HB JKNBP0070AFSC)
⑤ Guide (Large), Lever Switch (ST-1616H GCOVA1075AFSC, ST-1616HB GCOVA1075AFSB)
⑥ Signal Strength Meter (RMTRL0130AFSA)
⑦ FM Tuning Meter (RMTRL0129AFSA)
⑧ Tuning Control Knob (ST-1616H JKNBN0317AFSA, ST-1616HB JKNBN0317AFSC)
⑨ Band Selector Knob (ST-1616H JKNBN0330AFSA, ST-1616HB JKNBN0330AFSB)
⑩ Front Panel (ST-1616H HPNLC3326AFSA, ST-1616HB HPNLC3326AFSB)
⑪ Window, Front Panel (GMADD0051AFSA)
⑫ Dial Pointer with Lamp (HSSND0243 AFSA)
⑬ Dial Scale (HDALM0191AFSA)
⑭ FM Stereo Indicator, LED (VHPGL32AR//-1)

Figure 3 FRONT PARTS LAYOUT

REAR PARTS LAYOUT

(PHOTO: ST-1616H)



⑮ Leg (GLEGP0059AFZZ)
⑯ Output Socket (QSOCJ2263AFZZ)
⑰ Nut, AM Bar Antenna Retaining (XNESD40-32000)
⑱ Bracket, AM Bar Antenna (LANGQ0423AFZZ)
⑲ Screw, AM Bar Antenna Retaining (XBBSD40P45000)
⑳ Voltage Selector Socket (QSOCE0410AGZZ)
㉑ Bushing, Power Supply Cord
㉒ Power Supply Cord
㉓ Rear Panel (ST-1616H, LANGQ0590AFSA, ST-1616HB LANGQ0591AFSA)
㉔ Antenna Terminals (QTANN0452AFZZ)
㉕ DIN 45 325 type FM Co-axial Antenna Socket, 75 ohms (QSOCZ2179AFZZ)
㉖ Cabinet (GCAB-3054AFSA)
㉗ Bushing, AM Bar Antenna Lead Wire (LBSHC0002AGZZ)
㉘ AM (LW/MW) Bar Antenna (RCILA0426AFZZ)

Figure 4 REAR PARTS LAYOUT